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A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XLVI. No. 1188. SATURDAY, APRIL 4, 1942. 6D. PER COPY: POST FREE 8D.

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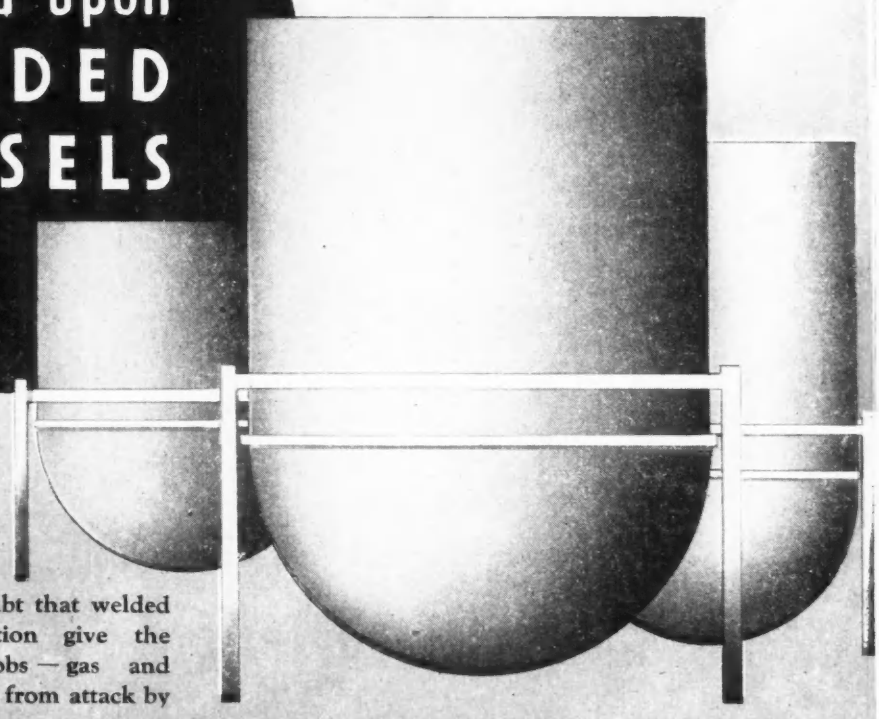

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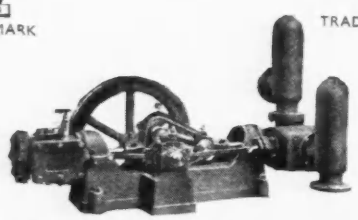

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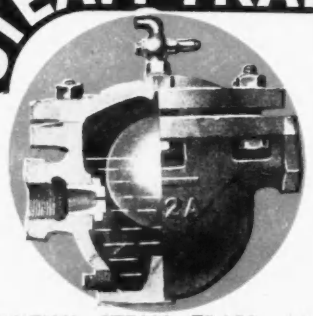

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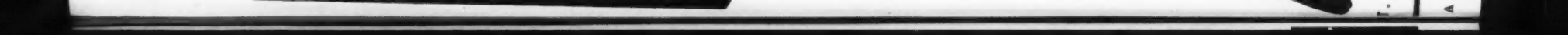

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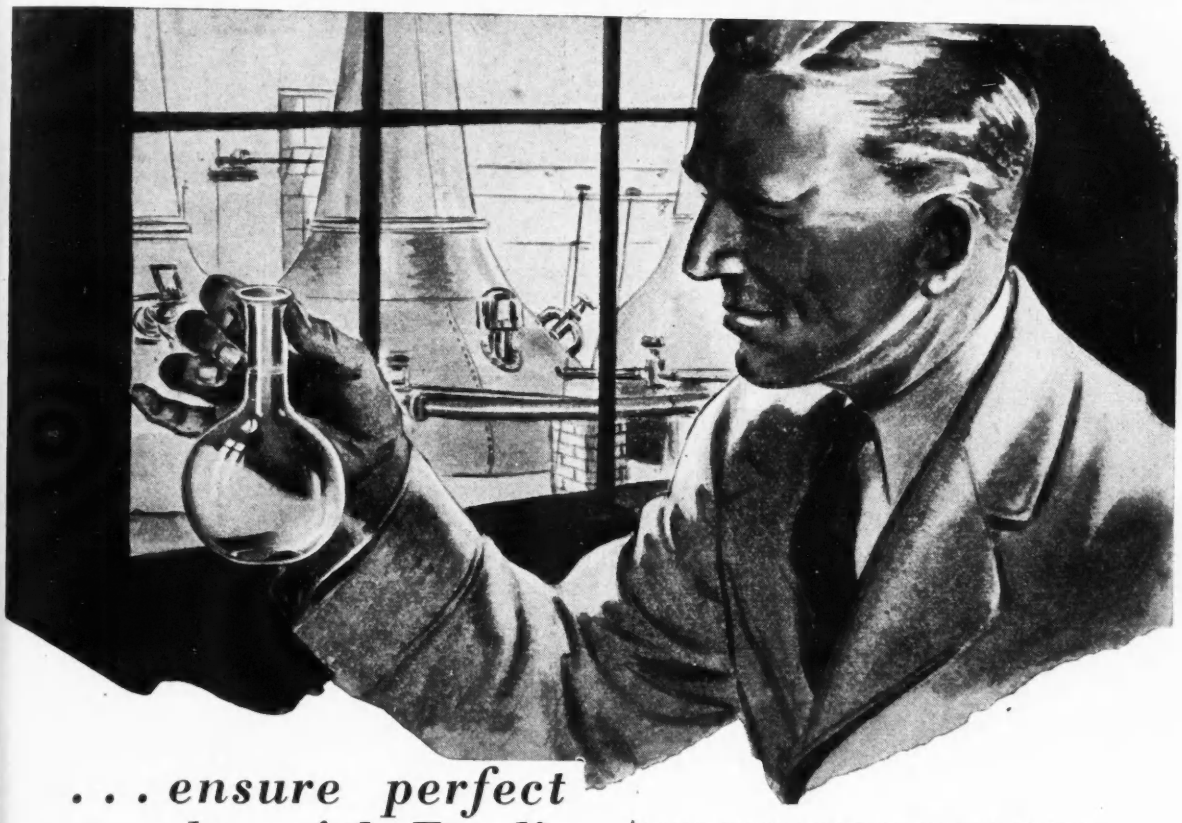

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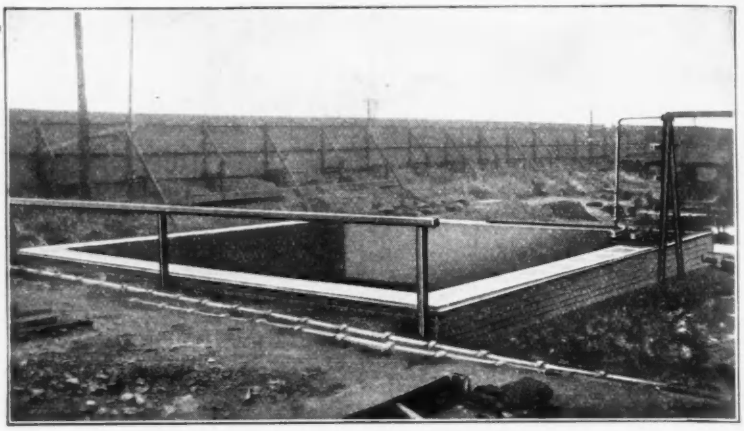

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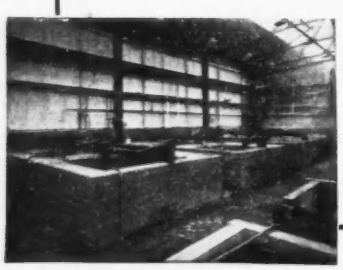

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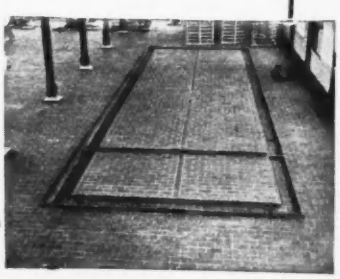

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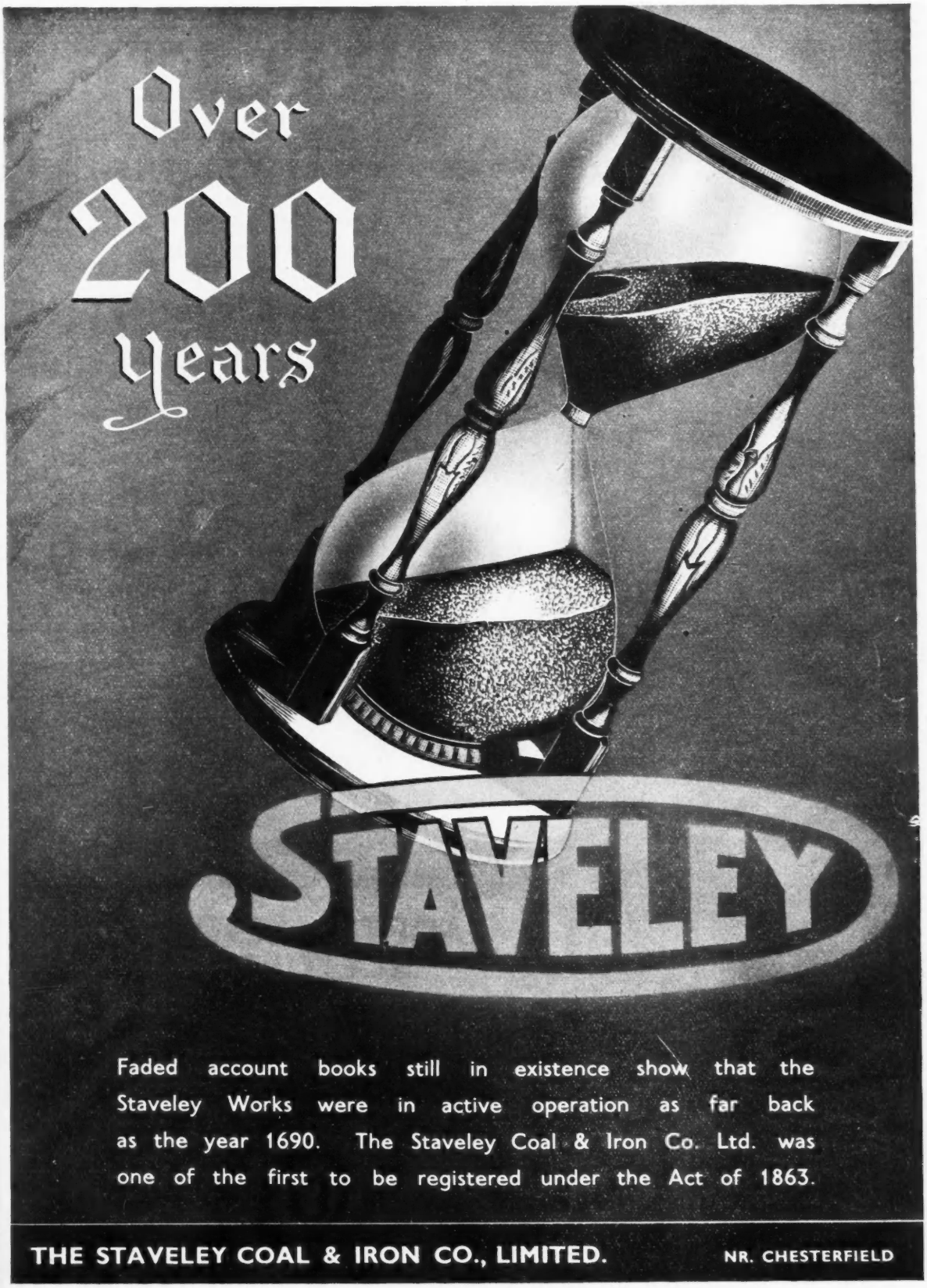

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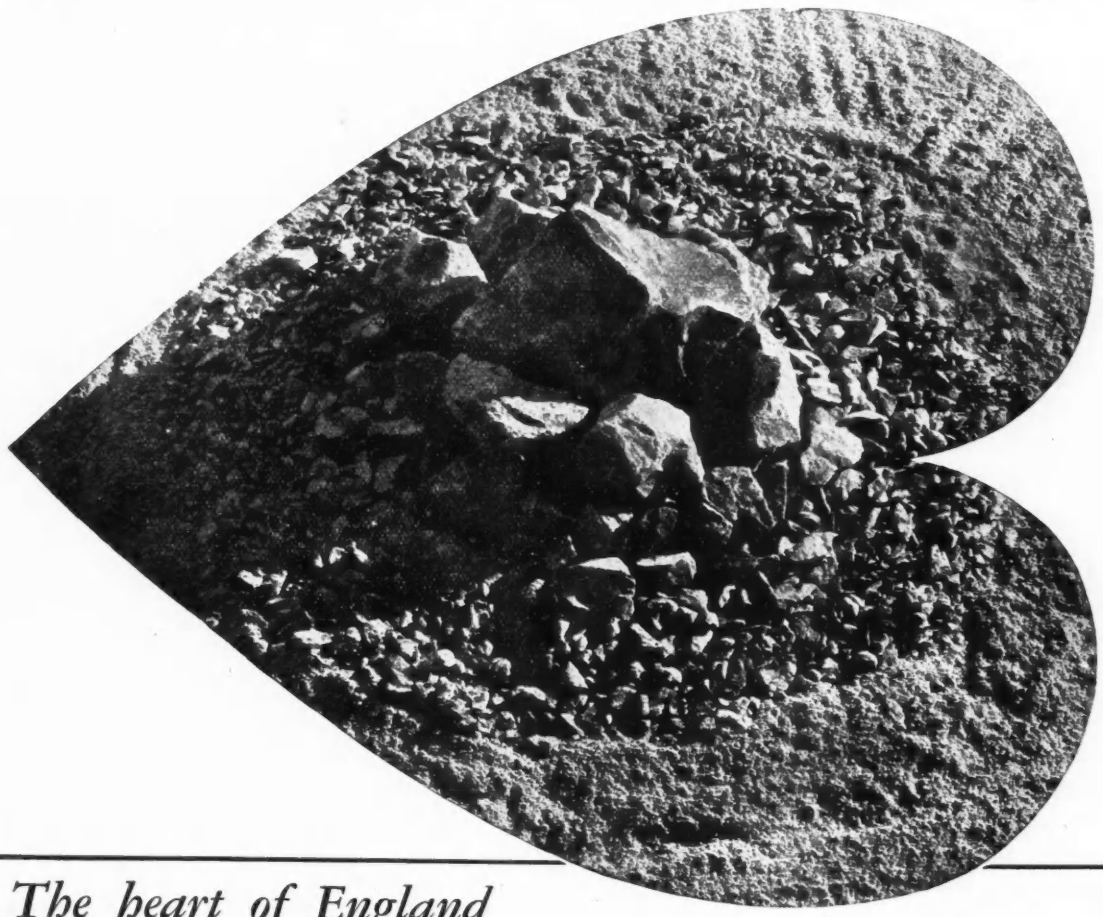

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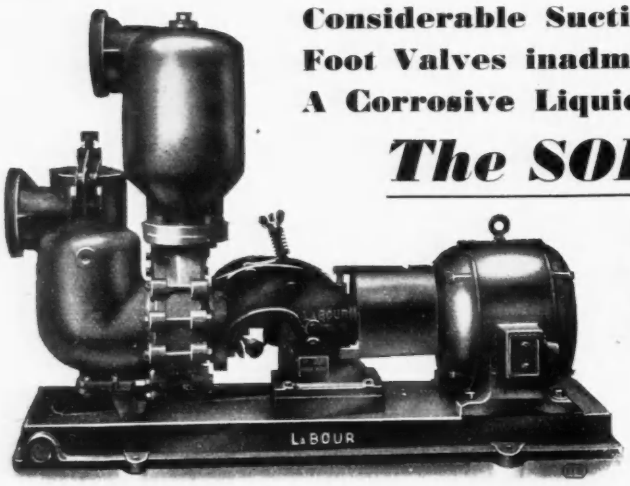

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VOL. XLVI. No. 1188 April 4, 1942 Annual Subscription, 21s. Overseas, 26s.

Industry—Organised or Regimented?

THE constitution of industry is fluid in the sense that it has changed by adapting itself to the social conditions ruling in the country. It is unnecessary to trace these changes through the ages. It will be sufficient to point out that in Victorian times industry was conducted by permitting free competition and by encouraging the start of new industries or the entry of new firms into existing industries. Wherever the individual saw the chance of establishing a business he was at liberty to do so. Business was conducted in an atmosphere of somewhat ruthless competition and the tradition of business secrets extended well into the present century; it is not even now completely defunct.

In those days a man entered industry or started a business for the purpose of making money and for no other reason. As labour became more educated, a system by which the few were able to make great fortunes, while the many were fortunate if they secured a continuous living wage began to be attacked, and a new purpose came into industry—a dual purpose. Industry was now seen to be (1) the production of goods required by the world in general and (2) a means of providing work, and therefore a livelihood, for everyone. Since unemployment affects the greatest number of people, security began to be of more importance than the production of goods and of infinitely more importance than the making of large profits. Ultimately, the question of organisation became important and for a great many years now public controversy, sometimes very heated, has raged in the political arena over the question of capital *v.* labour and State enterprise *v.* private ownership. Centralised units were advocated as a means whereby industry could attain the objectives of security with reasonable profits without the disadvantages of State ownership. The socialists, however, clamoured for State ownership.

Amid the turmoil of these conflicting opinions a third solution has emerged and, unlike the others, it is not confined to theorising or to paper plans, but has been put into practice widely throughout British industry. This is a system of private ownership with central control. A combination in which is included price-fixing arrangements, rings, cartels, market-sharing arrangements, combines and even monopolies obtained through concerted action behind the scenes, has spread over British industry. Where it was considered that there were too many units of production for reasonable profits to be made some units have been closed by mutual consent and the owners compensated out of a common fund. There are means whereby production can be controlled and whereby even new entrants into an established field of business can be discouraged. The development of these trade associations has been encouraged by the Government, and they have become recognised in war time as a source of strength, in that the industry can be instructed through a central body on the steps which the Government wishes it to take. Mobilisation of industry has been rendered much more simple, and what would otherwise have been impracticable has been put into practice through the work of these trade associations. The Government has made the trade associations responsible for organising the export trade and more recently for devising the system of concentration of industry in nucleus plants. There has recently been an attack upon this system, in which it is declared that State ownership has only been prevented because the Civil Service believes that it is neither competent nor willing to run industry. Unfortunately, as we have pointed out in an earlier leader, the Civil Service appears to be ready to issue orders to industry at any time and for any reason or for no reason at all without taking any responsibility for the subsequent confusion.

It is declared in some quarters that Great Britain has not yet seen the simple logic, which has been an accepted doctrine in the U.S.A. for half a century, that there must be legislation against the restraint of trade. It is maintained that by the system of trade associations there is destroyed the external force, either that of competition or public control, which is necessary to make certain that the individual in seeking his private profit is also ensuing the common good. It is further maintained that the Government should make plans for the organisation of industry, which, if we know anything of the Civil Service, will mean the regimentation of industry. Our knowledge of trade associations suggests that they rarely act as a restraint on trade and that their influence on stability of employment, the prosecution of organised research, international trade, and so forth, is in most instances wholly beneficial. If legislation is necessary, and we do not at the moment believe that it is, the greatest care must be taken that industry is not further handicapped by bureaucratic control. Nevertheless, the trade associations must not neglect to perform their own functions *in their entirety*. It is not sufficient to regulate trade and prices and to act in combination in the export markets—and so forth. There should always be co-operative research associations in every industry, and there should be means whereby new advances can be immediately tested at selected works, and the results circulated to all members. These associations must be used to advance trade, not simply to control it.

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NOTES AND COMMENTS

Synthetic Rubber Cartel

ADDITIONAL importance, if that were needed, has been given to Dr. J. G. Fife's appeal for an amendment of the patent laws (reported in THE CHEMICAL AGE last week) by the recent revelation of the nature of the cartel agreement between the Standard Oil Co. of New Jersey and I.G. Farbenindustrie. In evidence before a Congressional Committee, the Assistant Attorney-General of the United States, Mr. Thurman Arnold, has shown that an American process for the manufacture of synthetic rubber, which was withheld from American manufacturers, was made freely available to Germany, and that in 1939 the Standard Oil Co.'s subsidiary in Germany was helping to design aviation-spirit plants in accordance with an American formula. Although the Standard Oil Co. had secured from I.G. its process for making "Buna" it had delayed the use of the process in the U.S. because the Nazi government objected. Meanwhile the Standard Oil Co. had developed its own butyl rubber process, of the nature of which Germany alone, among foreign nations, had been informed up to the time of America's entry into the war. Independent producers in the U.S. had been refused the licensed use of the process.

U.S. Government to take over Patents

IN the course of further evidence Mr. Arnold stated that I.G. was found to have over 100 cartel agreements in the United States, while a similar agreement was under consideration in 1939 between Standard Oil and the Mitsui interest in Japan, of such a nature as to ensure re-establishment of contact between the two interests in the event of an outbreak of hostilities between their respective nations. This statement was later described by Mr. Farish, president of the company, in his testimony, as "entirely untrue." Far-reaching modifications of the U.S. Patent system have been suggested by Mr. Arnold, as a result of these revelations. Provisions to enforce the registration of all patent licence agreements made in the United States are already under consideration by Congress, and the Government has been urged to encourage the development of basic processes and to make the results of research available to all. It seems reasonably certain that the U.S. Government will take steps to break up existing monopolies and to take over, at least for the duration of the war, all vital patents upon which such monopolies have depended, and release them for the general advantage of the State.

The Chemical Engineers' Meeting

ALTHOUGH none of His Majesty's Ministers was present at the annual luncheon of the Institution of Chemical Engineers on Friday last week, the Institution was peculiarly felicitous in securing the honour of being addressed by Mr. Lall, High Commissioner for India, as a guest speaker. Mr. Lall, though as a civil servant he expressed himself bound to show caution in his pronouncements, was revealed as a good prophet when he described himself as an optimist regarding the relations between this country and his own, in view of last Monday's announcement of Sir Stafford Cripps's progress in the negotiations for the future status of India, despite the later news of the objections of Congress. Mr. Garland, as Chairman, divulged the fact that Sir Stafford in his younger days, though not a chemical engineer, had acquired merit by studying chemistry under Ramsay at University College. Earlier on the Chairman had delivered his presidential address, disarming his audience, with characteristic modesty, by declaring that what he had to say was hardly worth listening to. We feel sure that Mr. Garland will allow us to differ from this expression of a purely personal opinion; we, on the contrary, found his address of enthralling interest, even though, owing to a slight contretemps, it was not possible to show the lantern slides at the appropriate time, but after all their unexpectedness is one of the chief charms of lantern slides. At all events it may be safely said that the meeting was an unqualified success, and a large concourse enjoyed both the address and the semi-formal air of the luncheon which followed. The organisers of the meeting are to be congratulated on their efforts, especially in these difficult times.

A Censorship of Official Forms

BRADFORD, last Monday, was the scene of the 44th ordinary general meeting of the Bradford Dyers' Association, Ltd., and the chairman and managing director, Mr. George Douglas, took advantage of the occasion to express sentiments and opinions which clearly define the present industrial position, and with which a great many industrialists will be in sympathy. Naturally, he had one or two "grouses," but his complaints were not captious, and his criticism of present-day shortcomings contained a number of constructive suggestions. Perhaps the most revolutionary of these (it may not have been quite serious) was the setting up of yet one more Government Department—a censorship of official forms, whose job would be to see that no returns should be asked for that were unessential to the war. It is a fact that the accumulation of war-time controls and the call for returns of one kind or another acts as a distinct handicap to production; at the same time, as Mr. Douglas admitted later on, directional control is essential in war time. The majority of the Government controls are directed by experienced business men who are giving valuable service in these difficult times, and without their help distribution would have been chaotic and prices would have soared as happened with many uncontrolled materials in the last war.

Man-Power Problems

FACTORY owners, in general, are working to-day under a number of grave difficulties. In place of a steady flow of established productions, as Mr. Douglas pointed out, constant changes have been the order of the day, and the employment of substitute raw materials has often been obligatory. The difficulty of securing the necessary appliances and labour to deal with these differing materials has been constant, and this is a problem that has had to be faced by every industry. Man power as a whole is another vexed question, and Mr. Douglas, while expressing the hope that the cases where "concentrated" labour was inefficiently used were but few, voiced a general opinion when he said it would be reassuring to feel that there were no instances where more labour than could be efficiently employed had been requisitioned. By way of helpful suggestion, he asked whether a substantial addition to the output of munition factories could not be obtained, without sacrifice of national security, by temporarily transferring to them, from the very large Army in this country, a proportion of men who have completed their military training, subject, of course, to immediate recall.

A New Primer Pigment

FURTHER details have come to hand about a new rust-preventing anti-blister chromate pigment, which was described originally at the 102nd meeting of the American Chemical Society last autumn. The author, W. W. Kittelberger, of the New Jersey Zinc Company has published his paper (*Ind. Eng. Chem.*, 1942, *34*, 3, p. 363) and includes some very convincing illustrations showing the excellent results, under test, of his new pigment as compared with longer-established competitors. The new pigment, $ZnCrO_4.4Zn(OH)_2$ is known as "zinc tetroxychromate," or "ZTO," and appears to have several advantages over ordinary zinc yellow. It is much less soluble in water, and therefore yields more water-resistant films, and it is essentially free from the sulphate ions which encourage corrosion and are present to a greater or less extent, in the form of water-soluble SO_3, in the average zinc yellow. The most striking contrast between the protective effects of the new and the old pigments is offered by a series of panels which had been immersed for 650 hours in a 3 per cent. sea-salt solution. With ZTO, blistering was, at the worst, sporadic; with zinc yellow it was completely disfiguring. It would appear that ZTO has great future possibilities for protecting the underwater portions of bridges and ships.

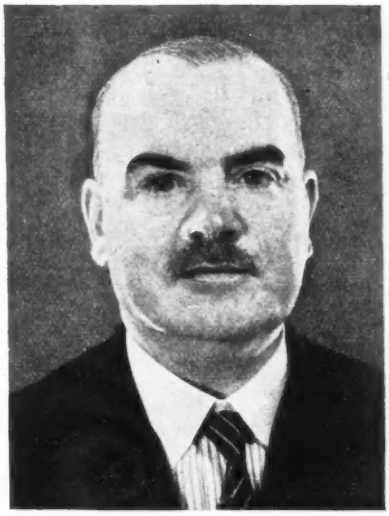
THE INSTITUTION OF CHEMICAL ENGINEERS

Twentieth Annual Corporate Meeting

THE twentieth annual corporate meeting of the Institution of Chemical Engineers was held on March 27 in the Connaught Rooms, Great Queen Street, W.C.2, with Mr. C. S. Garland (president) in the chair. After formal business the following officers were elected:—

President, C. S. GARLAND; vice-presidents, H. BEAVER, J. H. DOBSON, J. MCKILLOP, and A. PARKER; joint hon. secretaries, A. J. V. UNDERWOOD, M. B. DONALD; hon. treasurer, F. A. GREENE; members of Council, H. GRIFFITHS, C. S. ROBINSON, J. L. F. VOGEL; associate member of Council, W. COWEN.

The presentation of the Osborne Reynolds, Moulton and William Macnab medals followed. No award of the Junior Moulton medal and prize was made this year. The Osborne Reynolds medal, for meritorious service to the Institution, was awarded to DR. A. PARKER, whose valuable services as vice-president and as member of Council have extended over many years. MR. P. PARRISH, M.I.Chem.E., was awarded the Moulton Medal for his paper on "Modern Developments in the Design of Plant for Concentration of Sulphuric Acid"; and the William Macnab medal for the best set of papers submitted in the associate-membership examination was awarded to MR. E. W. PATES.



Mr. C. S. Garland

The report and accounts for what was described as "a most satisfactory year" were carried. After the meeting Mr. Garland delivered his presidential address, extracts from which follow.

"Chemical Engineering and Ceramics"—The President's Address

ONE of the greatest privileges accorded by this Institution to its president is the opportunity that it gives to him of presenting an address, in circumstances which any lecturer must regard as ideal. He is not expected to describe the results of some of his most recent research work but is at liberty to roam over the whole field of chemical engineering, even of industry, he is listened to in respectful silence, and tradition also decrees that at the end he should be spared a barrage of questions. I propose to-day, rather than to deal with some purely chemical engineering topic, to make a brief survey of a neighbour's field, the ceramic industry, and see whether there is something we can learn from his methods of cultivation, or whether perhaps there are some of his implements which it might be of advantage to us to borrow. I shall try to dissipate some of the contempt which chemical engineers have entertained towards the products of the potter such as utensils for holding liquids which developed cracks at the most awkward times, pipes that broke and valves that stuck at critical moments.

The products of the more recent developments of the ceramic industry are substantially pure synthetic chemical compounds with a composition more exact and more constant than that demanded from many ordinary chemicals of commerce and finished to a degree of accuracy commonly applied only to instruments or the special tools and gauges of the mechanical engineer.

The real pressure for improvement in the products of the ceramic industry always appears to have come from without, and the most highly technical demands upon the pottery have been those made upon it by the electrical engineer. Great refinements have been brought about by the demand of the electrical industry for ever higher quality porcelain to stand up to the increasing voltages at which, for reasons of economy in the size and weight of conductors, power was transmitted over long distances. The demand was for a truly homogeneous and highly vitrified insulator. The inclusion of the smallest air bubble in the plastic mass would reduce enormously the voltage at which puncture, *i.e.*, passage of an electric current, would take place. With the increasing size of electrical bushings loss by cracking in drying through the uneven extraction of the water vapour was a very serious matter, and this led to the development of a process of drying with wet air. The humidity of the air used for drying is maintained at a point not lower than that of the surface of the articles that are being dried, so that the drying takes place from the inside outwards, the humidity being reduced progressively as the outer surface dried.

In the meantime, the electrical industry had demanded the provision of many tens of millions per annum of small specially shaped insulators, and the potter was forced to borrow from the engineer the press with steel dies for this manufacture. At first a piece of moist clay mixture of about the right size was cut off, and pressed in the die; later the porcelain mass, after grinding, mixing, passing over magnets to remove particles of iron, and filter-pressing, was dried down to a moisture content of some 15 to 18 per cent. This moist powder was then pressed in pairs of dies, sometimes of very complicated shape, the pressed articles dried (either artificially or in the air) trimmed, placed in saggars and fired to vitrification. However, in spite of these advances the fundamental fact remained that the tensile strength of hard porcelain, even of the highest quality, was relatively low—only some 400 to 500 kg/cm^2.

It was the demand of the gas industry for gas jets resistant to sudden changes of temperature that brought the industrial working of steatite into prominence. It was found that whereas the percentage shrinkage of a hard porcelain article from the wet clay state (that is, when its dimensions can be controlled) to the fired article is some 25 per cent., the shrinkage from the turned natural steatite article to the finished state after firing up to the hardness of quartz or topaz (some 1450° C.) was of the order of 3 per cent. and was extremely regular. Moreover, the tensile strength of the fired natural steatite was much higher (800 kg/cm^2) than that of porcelain.

Articles turned from a natural stone were seriously limited in size, as it was rare for completely flawless or uncracked pieces to be found of total volume greater than a sixth to a quarter of a cubic foot. There was, therefore, a very natural desire on the one hand to make use of the waste material and on the other hand to be able to produce larger articles having the qualities of strength, toughness, high surface resistance, and tensile strength of the natural steatite. The soapiness and resistance to wetting of the powder rendered abortive the attempts to throw

and turn this on established pottery or porcelain lines. It was found, however, that if a considerable proportion (60 to 70 per cent.) of the powder were fired to some 900 to 1000° C. at which it had lost its soapiness, it could be incorporated with a small proportion of felspar to produce a silicate with a high proportion of magnesium and a very small proportion of potassium (less than 2 per cent.).

Attempts were made to employ steatite in the same way as aluminium silicate or china clay for the pressing of small articles, and in the course of these it was discovered that if the perfectly dry powder is pressed to some 300-400 lb./sq. in., it is aggregated to a solid coherent mass which is sufficiently strong to be dropped off an automatic machine on to a band. This became the basis of the process properly known as "dry pressing." In this, a truly dry powder containing less than 2 per cent. of moisture is pressed in a steel die to the final shape, and the shrinkage from the die size to the finished article is of the order of 8-9 per cent., and the goods produced were of a higher order of accuracy than was possible with the older wet pressing porcelain process. When fired to 1450° C. they had a tensile strength of substantially the same order as natural steatite.

Synthetic Magnesium Silicate

Meanwhile, under the stimulus of competition, a certain group of manufacturers in the electrical porcelain industry, being denied a source of natural magnesium silicate, eventually produced a synthetic magnesium silicate, from chemically prepared magnesia and quartz, which not only had all the properties of natural steatite, but in several respects was distinctly superior. This product has become of vital importance in connection with short wave transmission, and it is no exaggeration to say that the whole of the present communications between individual units of our ships, armies, and air forces are dependent upon its qualities. Synthetic magnesium silicate has taken the place of mica to a very large extent in the construction of resonant circuits. The discovery of the remarkable properties of synthetic magnesium silicate led to research in regard to a very large number of other analogous compounds, amongst others the synthetic spinels and the compounds of magnesium and titanium.

One property of magnesium silicate which is of great interest to chemical engineers, and is already used extensively in the electrical industry, is that it is possible to deposit on it a highly coherent layer of silver which can then be electroplated to any desired thickness with copper, and any other metal may be deposited on it and other metal parts attached by soldering with any solder suited to the metal and the requirements. The material, however, has other properties, hardness (between that of quartz and topaz), toughness represented by its resistance to fracture under impact, high elasticity, high compressive strength and capacity to take a very high degree of polish. In order to make full use of these properties another radical change was made in the methods of the pottery industry. The process was for mixing the clay body with water to a plastic mass, throwing or pressing or extruding this to the desired shape, drying and then firing to 1450° C. In the course of the firing there were two distinct periods of change over which the firing must be conducted slowly and carefully; first about 450° C. when the combined water is driven off, and again at some 900° C. when certain changes in crystalline form of the silica and silicates take place. Above this temperature there is relatively little chemical change in the product as it was found that if the firing was stopped at about 900° C. the resulting product, while so hard that it could be readily handled or worked, was yet soft enough to be treated like any metallurgical product. It could be sawn, ground, drilled, shaped, milled and gears and screws could be cut. As an instance of the value of this to chemical engineers, I may mention that in 1939 I saw a pump made of magnesium silicate, including the roller bearings, the gear wheels, the key and the shaft with its keyway, running continuously for three weeks, the gears and rollers being water-lubricated, at 3000 r.p.m. pumping nitric acid.

Pressing of Metallic Powders

While the ceramic industry has taken to itself the methods of the engineer to the extent that in one modern porcelain factory of which I have knowledge one-third of the area is occupied by the machine shop, where every conceivable variety and size of machine tool is working on these synthetic products, the metallurgical industry has adopted the method of dry pressing developed by the potter. The manufacture of small metal parts by pressing fine metallic powders together and sintering the products, *i.e.*, bringing them to the point where their edges melt, begun experimentally in 1934, has so developed that to-day the modern car has 30 parts which, instead of being smelted, cast, rolled, extruded, drawn, and then drilled, machined, hobbed, and ground, are simply pressed from metallic powders into solid shapes. This offers a very considerable saving in skilled man-hours in the production of complicated metal parts.

At present over 5000 tons a year of metallic powder are pressed into metal parts each year in the United States, an increase of 25 per cent. over 1940, in an industry which started only in 1936. Metal porous filters are available to the chemical engineer. Even metallic screens of comparatively large mesh can be pressed, so avoiding the necessity for drawing wire and weaving it. This process also promises to have serious repercussion on the steel industry. There are extensive deposits of iron ore of low grade (20 to 30 per cent.) which it is not economic to use in ordinary smelting processes. One of Ford's research engineers, Robert Boyer, has worked out a method for producing powdered iron by the electrolysis of ferric chloride obtained by the treatment of these low grade ores by hydrochloric acids. This iron which, because of its extreme purity, is soft and ductile, is said to resist corrosion better than ordinary smelted iron, and is peculiarly adaptable to manufacture by the powder pressing process.

It would seem that the three main industries which supply the chemical engineer with his material of construction, the metallurgical industry, the ceramic industry, and the plastics industry, are all moving along the same general lines, that of the production of the finished part without intermediate processes by the pressing of powder, and I put these few remarks before the Institution with a view to suggesting that ceramics as materials of construction, now that they are available of high strength, toughness, and to very high orders of accuracy, are worthy of further study and perhaps greater respect by chemical engineers.

The Institution Luncheon—Mr. Lall's Speech

MR. GARLAND was in the chair at the luncheon of the Institution which, as has become customary in war time, took the place of the annual dinner. The venue, like that of last year, was the Connaught Rooms.

After the loyal toasts, the Chairman, in a brief and amusing speech, proposed the health of "The Guests." In mentioning the name of Mr. Lall, High Commissioner for India, one of the guests of honour, he called attention to the fact (which is not generally known) that Sir Stafford Cripps had been trained as a chemist under Sir William Ramsay at University College; hence his rapidity in getting things done. The Chairman also noted the significance of the presence of Lord Dudley Gordon, President of the F.B.I., on the list of speakers, at a time when government control of industry was so much in the air.

MR. S. LALL, C.I.E., I.C.S., High Commissioner for India, in response, confessed himself an optimist with regard to the relations between this country and India. Though not himself a chemical engineer, he fully realised the services to humanity for which chemical engineering is responsible. As he put it, "you need not be yourself a musician in order to appreciate good music." There was much leeway in chemical engineering to be made up in India. Although India was now one of the eight chief

industrial countries of the world, as well as being a great agricultural country, he was not yet satisfied with what India had done. Though India, like every other peace-loving nation, was caught unprepared at the outset of the war, the Government and industry were making herculean efforts to overcome past deficiencies. He referred to the Eastern Group Conference, directed towards self-sufficiency in war supplies among the countries East of Suez. To one who knew India, the progress there in the last two years was amazing. On the chemical side, for example, enough bleaching powder was now made to allow of a surplus for export; and indigenous drugs were being substituted for imported products. He was particularly gratified by the increasing number of Indian science students in this country and by the facilities for the training of Indian workers in Royal Ordnance factories. In the future industrial expansion of India, the chemical industry must play a leading part; fertiliser manufacture, for example, would revolutionise agriculture, leading to increased production and the possibility of a higher standard of living for Indian workers.

LORD DUDLEY GORDON, who seconded the response, pointed out that production for the war effort did not end with tanks, ships, aeroplanes, and the like; an important part of our industrial effort passed out of the country, and though the primary function of industry was to further the war effort, it had also to consider plans for post-war development. Our aim must be so to organise a world-wide industry after the war that everybody was fully employed. As he cogently put it, if every Indian and Chinese peasant could have a shilling a week more to spend on manufactured articles, the whole employment problem would be solved.

Among those present at the luncheon were: Sir Noel Ashbridge, Sir Peter Bennett, M.P., Dr. W. Braunholtz, Mr. T. S. Chegwidden, Dr. W. Cullen, Sir Henry Dale, Dr. A. E. Dunstan, Professor A. C. Egerton, Dr. H. J. T. Ellingham, Lord Falmouth, Dr. J. J. Fox, Dr. G. E. Foxwell, Sir John Greenly, Professor A. V. Hill, M.P., Sir Charles Hipwood, Professor B. W. Holman, Professor C. E. Inglis, Dr. H Levinstein, Sir Charles McLaren, Lord Melchett, Sir John Nixon, the Hon. S. M. Lanigan O'Keeffe, High Commissioner for Southern Rhodesia, Sir William Palmer, Mr. P. Parrish, Capt. L. F. Plugge, M.P., Lord Rayleigh, Mr. F. Heron Rogers, Mr. J. F. Ronca, Mr. W. M. Selvey, Dr. Felix Singer, Dr. E. W. Smith, Lt.-Col. R. J. C. Thompson, Col. S J. Thompson, Sir Henry Tizard, and Dr. G. S. Whitby.

LETTERS TO THE EDITOR

Separation Process Required

SIR,—I should be interested if you could put me in touch with any firm who is operating a process to separate non-magnetic metallics from sand.

From our grinding shop we recover a dust which consists of approximately equal amounts by weight of grinding wheel dust and non-magnetic, non-ferrous metal powder. Wet separation processes do not appear to be satisfactory and I should be interested to learn if there is any centrifugal separating process by which the work could be carried out.—Yours faithfully

M. RIDDIHOUGH, M.Met., A.I.C.

Solihull, Warwickshire.
March 30, 1942.

Spontaneous Combustion of Wood

SIR,—The spontaneous combustion of wood and other similar organic matter has been discussed by Haldane and Makgill (*J.S.C.I.*, 1934, *53*, 359 T), where many instances of rapid oxidation are cited. Decayed wood, especially from water-logged soil, is particularly liable to oxidation on drying.

In the discussion to the paper quoted above, I recorded two instances from my own experience: (1) In the examination of a decayed greenheart pile, a small amount of a crystalline solid was recovered, which deflagrated on drying in a test tube, somewhat in the manner of ammonium bichromate. (2) Some fragments of a rotted oak post were being dried in a thermostatically controlled oven at 65-75° C. After a few hours, a bulky heap of ashes was found, though the sheet of paper on which they were standing was merely charred.

I suggest that Dr. Schweig may find his experience linked up with the many instances of spontaneous combustion described in Haldane's paper and the discussion thereon.—Yours faithfully,

ERNEST A. RUDGE, Ph.D., A.M.I. Chem.E., F.I.C.
Head of Dept. of Science,
West Ham Municipal College.

London, E.15.
March 30, 1942.

SIR,—I have read the letter from Dr. Bruno Schweig on the fire caused by steam heated pipes, and suggest it was due to spontaneous combustion.

Steam pipes, even those carrying low-pressure steam, when in contact with wood over a period of years will cause charring which is in effect a deposit of finely divided carbon. It is well known that finely divided carbon absorbs gases and develops heat in consequence, often resulting in spontaneous combustion. Since this phenomenon is a surface physical change, it follows that the more finely divided the carbon, the greater is the heat developed, and the greater the risk of fire by spontaneous combustion.

Without being able to recall the source of information, I have been aware for many years that steam pipes in actual contact with wood will eventually become a fire risk due to carbon formation.—Yours faithfully,

TREVOR A. EVANS.

Stafford.
March 30, 1942.

Special Adhesives in Germany

Substitutes to Suit Individual Needs

ACID-RESISTANT cements and mortars have been much developed lately in Germany, but none seems to be of a quality permitting universal application, and the tendency is therefore towards the development of special brands to meet individual requirements. For "Asplit," a synthetic resin material, which was marketed in England before the war, considerable resistance against acids (including mixtures of 75 per cent. hydrofluoric acid and 95 per cent. sulphuric acid), pressure, and liquid penetration is claimed; owing to good adhesive properties it can be applied to timber as well as concrete structures. "Aristogen," a stable bituminous emulsion, is offered to builders as an insulation material which can be applied at normal temperatures on wet surfaces; it is free of tar and phenol, not liable to catch fire, withstands comparatively strong acid concentrations, is used for insulation against ground water, and also enters various bituminous fibre masses. "Asfluid" is the name of a series of bituminous substances used for protective coatings on roofs, chimney joints, tar-free insulation materials, etc.; it is claimed to form a film possessing great resistance against dry heat, salts, and strong acids. "Höchst" water-glass mastic products are stated to be self-hardening, even in the absence of air, and to protect against all acids (except hydrofluoric), chlorine and bromine up to temperatures of 1000° C., steam, and neutral solutions of salts, but they offer only temporary resistance to alkalies. Special types have been developed for which great resistance to liquid penetration or to sulphuric, acetic, and phosphoric acid are claimed. They can be prepared with water instead of water-glass and are stated to harden very quickly. None of the preparations has been able to conquer the whole market, and it seems therefore that they have serious drawbacks as compared with the natural materials which they are designed to replace.

Personal Notes

MR. HERBERT DAVIS, C.B.E., joint vice-chairman of Lever Brothers and Unilever, Ltd., has been elected a member of the Baltic Mercantile and Shipping Exchange, Ltd.

CAPTAIN C. G. C. HOLMYARD, Manchester Regiment, reported as missing at Singapore, is the son of Dr. E. J. Holmyard, F.I.C., editor of *Endeavour*, who will welcome any information at Larch Wood, Wraxall, Somerset.

DR. JOHN MONTEATH ROBERTSON, M.A., Ph.D., D.Sc., who was appointed senior Lecturer in Physical Chemistry at Sheffield University in 1938, has now been appointed by Glasgow University Court to the Gardiner Chair of Chemistry, as from October 1 next, in succession to PROFESSOR T. S. PATTERSON, whose resignation takes effect from that date.

MR. HAROLD HENRY BOWEN, chief chemist of the Bradford Dyers' Association, Ltd., has been elected a director of the Association to fill the place vacated by MR. P. K. WHITEHEAD, who has retired at his own request, after a period of service to the Association dating from 1913. The election was announced at the annual general meeting on March 30.

LIEUTENANT F. R. D. CORBETT, R.N.V.R., who has been awarded the D.S.C., took charge of a minesweeping trawler after the commanding officer had been killed in a bomber attack. He personally worked the guns during each attack, and in the intervals attended the wounded, helped to put out a fire, and took measures for the safety of the crew. Lieut. Corbett succeeded his father as manager of the London office of Messrs. Tanks and Drums, Ltd. He joined the R.N.V.R. about six months before the outbreak of war.

Obituary

MR. ALPHONSE SHARP, who died at Halifax on March 28, aged 69, was founder and head of the chemical and colour-making company of A. Sharp and Co., Ltd. Mr. Sharp was born at Roubaix, France, where his father managed a large dyeworks at the time of the Franco-Prussian War. Some time after the family had returned to England, Mr. Sharp started business on his own account as a colour and chemical manufacturer at Copley. During the last war he organised a large-scale production of explosives and was created C.B.E. for his services.

Chemical Matters in Parliament

Scientific Food Committee

SIR E. GRAHAM-LITTLE asked the Parliamentary Secretary to the Ministry of Food what was the present position of the Scientific Food Committee described in 1940 as advising the Minister on measures dealing with bread; and whether this committee had been superseded in this respect by his scientific advisers.

Sir J. Anderson stated that the functions of the Scientific Food Committee had not been amended. The answer to the last part of the question was in the negative.

Alternative Fuels

Mr. Ellis Smith asked the Secretary for Mines whether he could make a full statement on the steps to be taken to encourage the use of alternative fuel and the utilisation of producer gas in particular; whether he had received the report of the committee that investigated this problem; and, if so, what steps were being taken on the report.

Mr. David Grenfell replied that he received last week an interim report from the technical committee on the development of producer gas vehicles, and that the report of Lord Henley's committee on fuels suitable for this purpose had just been completed. It was not yet possible for him to make a full statement on the steps to be taken to encourage the uses of alternative fuel, but these reports on producer gas were closely examined in relation to other methods of reducing the imports of oil. He expected to be able to give an adequate reply shortly.

Alumina from Clay

German Patents use Low-Grade Material

LOW-GRADE clays hitherto regarded as unsuitable may become the source of large supplies of aluminium according to the process developed by Séailles and Dyckeroff. The patent is assigned to three German firms. The inventors claim to have perfected a cheap and simple method of recovering alumina of high purity from low-grade clays, slate, and slags containing small amounts of alumina and a large percentage of impurities. The process involves calcining the clay with lime or limestone, which is used in a definite ratio to the amount of alumina and impurities present in the clay.

The calcining is said to produce a calcium aluminate that can be dissolved from the ashes with water, while the silicon, iron, and titanium impurities remain behind. The dissolved calcium aluminate can then be treated to recover alumina of high purity which can be processed in the usual way to obtain aluminium metal.

In another patent, likewise relating to a method for recovering aluminium from low-grade clays, the silicon impurity is burned out with carbon. The clay is ground into powder, then mixed with carbon, and the mixture heated under slight vacuum to a temperature of 1200° C. The silica impurity reacts with carbon to form silicon monoxide, a gas which is expelled from the clay while leaving behind silica-free alumina.

Lac Reactions

Neutral Medium for use with Metallic Pigments

TECHNICAL papers of the utmost interest continue to be published with commendable frequency by the London Shellac Research Bureau, the latest of these being No. 21, on the reaction of lac and lead tetra-acetate (by B. S. Gidvani and R. Bhattacharya), and No. 22, on the reaction of lac with metallic oxides (Part I of a study by N. R. Kamath and R. Bhattacharya). Both papers throw further welcome light on to the obscure problems of the chemistry of lac.

In the attempt to secure the oxidation of lac with lead tetra-acetate (red lead and acetic acid) the authors found that some oxidation takes place, resulting in the reduction of the yield of aleuritic acid. The indication is that the adjacent hydroxyl groups of aleuritic acid in at least some of the lac resin molecules are free. Incidentally, a modified resin with higher softening and melting points has been obtained. The general film properties of the modified resin have been studied. Two different values were obtained for scratch hardness, depending upon the direction of the film subjected to the test. The direction along the flow gives a higher value than the one at right angles.

In the second study, the authors found that when solutions of lac in methylated spirit are refluxed with certain metallic oxides, there is an increase in viscosity. The formation of the salt of lac concerned is not the only reaction which occurs and the product can be dissolved in the usual organic solvents or solvent mixtures generally used for the resin, giving solutions possessing abnormally high viscosities. Both types of solution, *i.e.*, the solutions obtained by refluxing with metallic oxides and the solutions of metallic soaps, prepared by adding aqueous solution of metallic salts to alkaline solution of lac, give hard and glossy films which possess increased toleration for plasticisers. The Zn soaps of whole lac, ether-soluble and ether-insoluble fractions, are acidic and are probably complex salts.

The properties of the films obtained from the solutions suggest their application as varnishes or coating compositions. Some solutions are suitable, for instance, for metallic pigments such as bronze, aluminium, and Luminophore, for which spirit varnish, owing to its acidity, cannot be used. Basic pigments, such as zinc oxide and white lead, can safely be incorporated into varnishes treated with suitable metallic oxides.

Metallurgical Section

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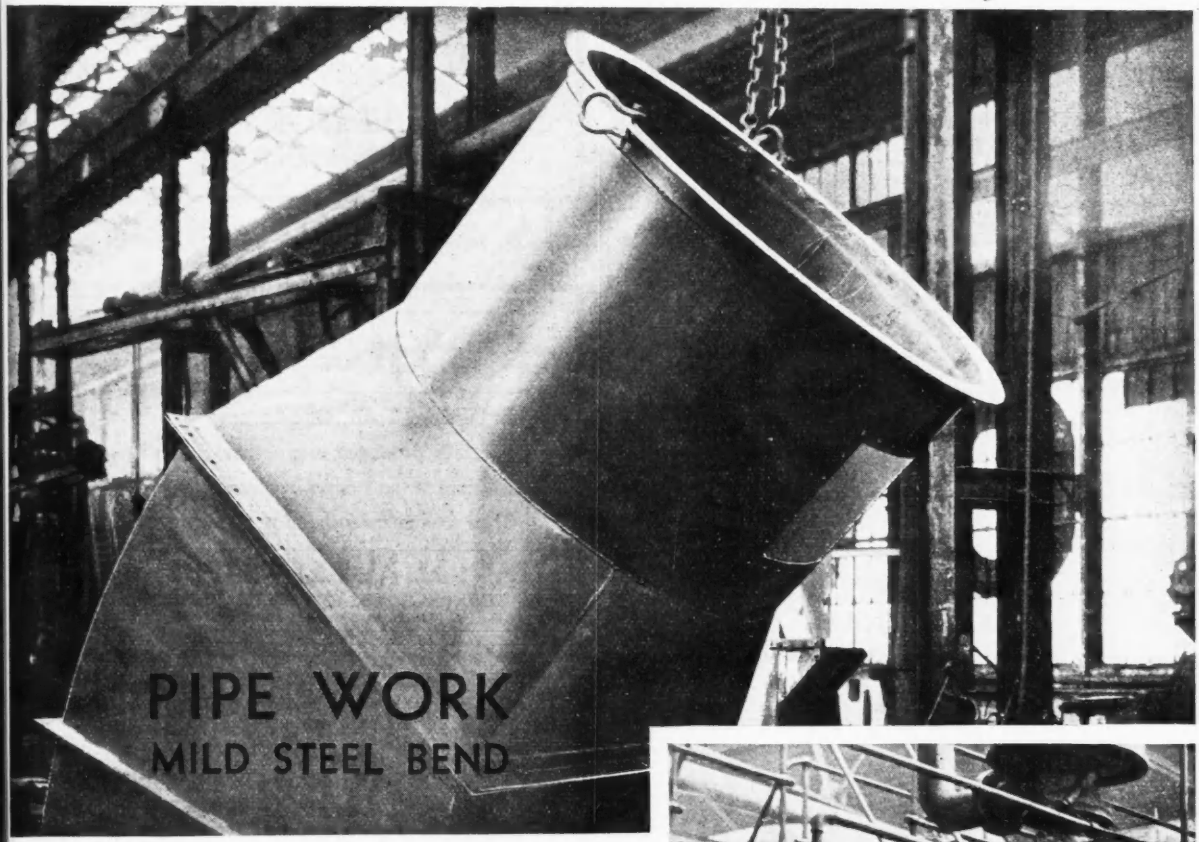

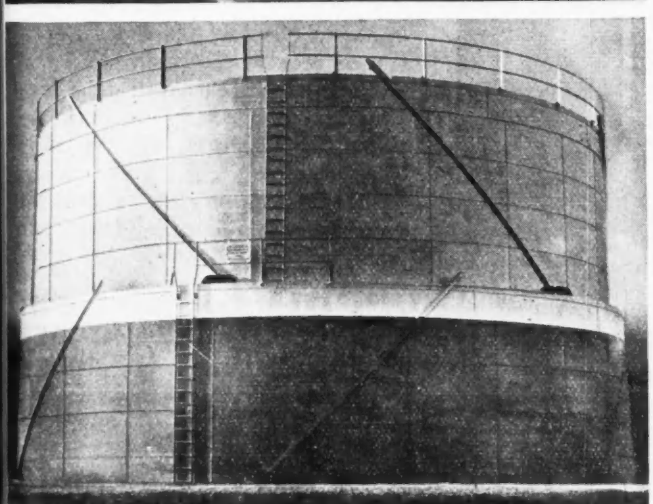

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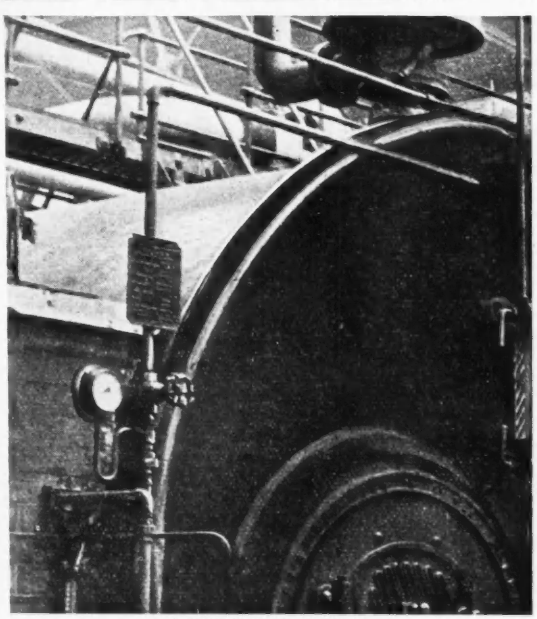

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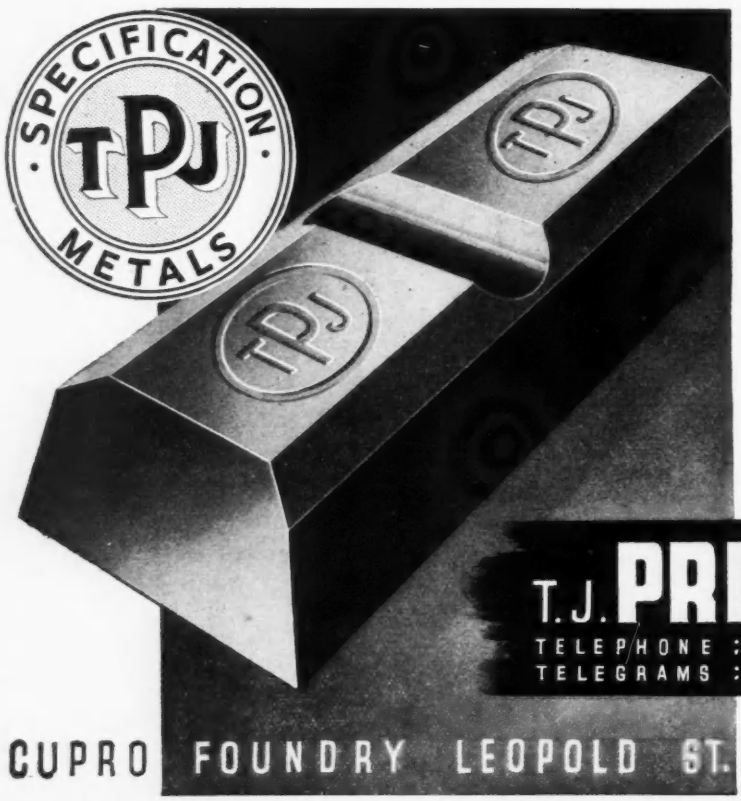

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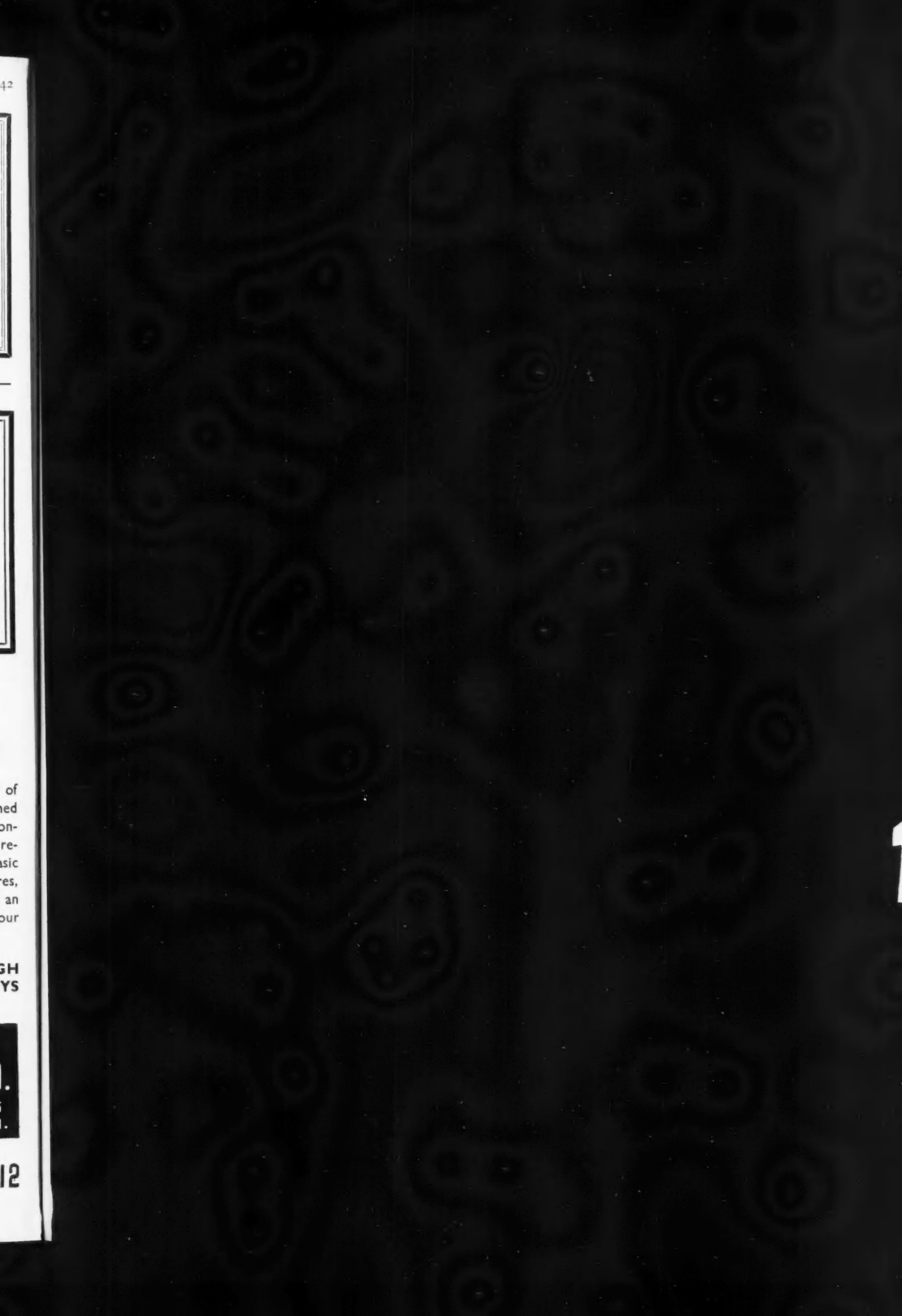

Metallurgical Section

April 4, 1942

FLUXES FOR ALUMINIUM ALLOYS

Practical Precepts for Melting, Welding, and Soldering

by OTTO EINERL, Dr.Eng., and FREDERIC NEURATH, Ph.D.

FLUXES for aluminium and its alloys have been developed and applied empirically for the most part and scattered statements in publications, which are often contradictory, are mostly restricted to the specifications of mixtures which proved suitable in one case or another. Scientific investigations on this subject are not numerous and the practical metallurgist is therefore dependent on empirical or traditional methods, which must be regarded as axiomatic only so long as no better scientific foundation is available. The paper which follows is an attempt to survey, in a clear and simple way, the theory and practice of fluxes for melting, welding, and soldering aluminium and its alloys.

The question of fluxes for aluminium is as old as the aluminium industry itself and the problem has its start in the fact that, unlike nearly all other metals and their oxides, the aluminium oxide Al_2O_3 has a specific gravity the same as or higher than that of pure aluminium or aluminium alloys. Consequently, when melting aluminium, the aluminium oxide does not rise to the surface, but remains partly within the metal; it is necessary, therefore, to ensure purification of the molten metal by means of a flux. In addition, on the surface of the purified metal bath, through the influence of atmospheric oxygen, a new aluminium oxide film is formed, and it is also the task of a flux to prevent this as much as possible. The strong affinity of aluminium for oxygen is the reason why a similar, though much slower, oxidation takes place on each exposed surface, whether hot or cold, of cast, rolled, or drawn aluminium or aluminium alloy. This is the point where the flux problems for melting, welding, and soldering meet, as the difference is only in the temperature to which the metal is brought, and the applied fluxes are not different in principle, but only in their adaptability to special conditions. The proper allowance has therefore to be made for the lower working temperatures as well as for the chemical reactions which only occur at higher temperatures. Fluxes used for melting aluminium and its alloys are reviewed first because they exceed in quantity the fluxes for welding and soldering and because in the melting process nearly all the problems of the various fluxes can be dealt with.

Fluxes for Melting

Besides freeing the aluminium bath from the oxides of aluminium or its alloying elements and reducing the surface oxidation to a possible minimum, the flux has also the function of protecting the liquid metal against gases, especially steam, which dissolve in or react easily with aluminium. The molten flux itself may therefore have a small gas permeability or one of its components may work as a protecting atmosphere, or it may even contain substances which effect the removal of gases soluble in aluminium, by liberating gases insoluble in aluminium. Such a flux works therefore as a "degasser." The reverse, however, also occurs, if the flux material is required to develop a certain known amount of gas, *e.g.*, steam, from water of crystallisation, to effect a gas supply for making difficult gravity die castings in aluminium alloys.

The flux can, furthermore, be used as a means of adding small quantities of certain alloying elements; these are added to the flux in suitable compounds and liberate, by reaction with the aluminium, the additional metal, which then dissolves in the molten alloy. On the other hand, the flux or one of its components can be used to remove undesired components, though only by sacrificing a considerable percentage of the original alloy. This function has been applied during the war on a large scale especially since it became necessary to make use of great amounts of Duralumin and other scrap from wrought alloys and to turn them into magnesium-free casting alloys by eliminating their Mg content as far as possible. This task of the fluxes could be described as a "selective protection" of the aluminium alloys. Very different effects may thus be expected from the fluxes, which can be applied either singly or successively or in suitably combined mixtures.

The Requirements of a Good Flux

Before deciding whether a flux has to be used and, if so, which flux to use, the problem must be studied in each separate practical application by a careful examination, as wrongly applied fluxes or "universal" fluxes, claiming to be "good for everything," can often do much harm. What requirements, after all, has a good flux to fulfil, so that it may satisfy as completely as possible the various demands mentioned above, keeping in mind the cost?

A. Elimination of water.—A general first rule, with which all experts agree, is that the success of the flux treatment depends on the careful drying of the flux. As most of the materials used are more or less hygroscopic, they must either be packed, after careful drying, in aluminium foil, or kept in tight aluminium cases and applied in certain weighed quantities to the molten metal. If flux covering is intended for large crucible or furnace surfaces, it will be advisable to keep the flux mixtures ready mixed and dried (at a temperature of at least 250° C.) and stored in heated magazines.

The above can be justified on two grounds, first, because the use of damp fluxes on molten metal would be dangerous for the smelter, as the violent development of steam causes splashing of liquid metal, and secondly, because the steam is by itself a danger to the aluminium, since, by contact between the liquid metal and the activated molecules of steam, the following reaction takes place: $2Al + 3H_2O = Al_2O_3 + 3H_2$. The hydrogen thus formed dissolves in the liquid aluminium and is only set free—provided that it is not driven out before by means of a "degasser"—when the alloy solidifies, resulting in very porous and useless castings.

It is clear that, as the presence of water is harmful, both the fluxes and the metal scrap to be melted under a flux layer ought to be quite dry. The light alloy scrap (shavings, turnings, borings, grindings) to be melted generally contains considerable amounts of moisture (soapy water, bore oils) so that a preceding desiccation in drying plant at 300° C., or a purification by centrifugal machinery, washing with phosphate solutions and drying at 110° C., is necessary, before it can be melted under a cover of flux.

In the first case it is not practicable to remove the last traces of moisture or burn the grease away completely, as otherwise a film of aluminium oxide would form on the surface of the aluminium scrap, which is most undesirable for the melting process.

Aluminium borings or turnings, left in contact for some

weeks with soapy water and showing heavy surface corrosion, due to the formation of hydrated aluminium oxide, yield up water not when drying, but only while melting. The adsorbing capacity of this hydrated oxide continues up to temperatures of 500-600° C. This chemical dehydration, when occurring under cover of flux, can be harmful to both metal and flux.

The other method (washing and drying the aluminium scrap), although more expensive and requiring more apparatus, is certainly the coming method, because the films of phosphates, metaphosphates, and other salts, which are used in the washing and degreasing processes already partly fulfil the function of the fluxes necessary for the melting process.

B. Physical conditions.—Specific gravity, viscosity, porosity, gas permeability, surface tension, and melting point of the flux as well as possible heat-insulating properties are important and essential points for the technological study of whether a flux is qualified for its special purpose.

Specific Gravity Requirements

It is obvious that the specific gravity of the flux, which is supposed to float on the surface of the molten metal, must be lower than the specific gravity of the alloy which has to be protected. A flux for aluminium alloys must therefore have at most a specific gravity of about 2.5 (0.09 lb./cu. inch). Although exact figures are not to be found in the literature, it may be supposed that on an average the specific gravity of a cold dry flux is reduced during the melting process by about 10-20 per cent.

For the viscosity of the molten flux no reliable test exists except that of practical experience. Freshly applied fluxes are mostly very fluid, but they become gradually more viscous by the infiltration of miscellanous substances, such as suspended films of metallic oxides, and through loss of volatile components, and finally they become so tacky that, according to the quality of the melting material and to the size of the bath surface, they have to be taken off and replaced. A liquid flux does not represent a "liquid lid," but a sort of sponge, covering the metal in a more or less porous condition. In connection with it the question of gas permeability may be considered, but little more is known about this than that porosity and gas permeability increase with the higher temperature of the molten flux *above* its melting point, presumably advancing with the increase of surface tension. The protection of the metal below the flux will therefore diminish and become insufficient when the melting point of the alloy is far above the melting point of the flux. On the other hand, the flux must be perfectly liquid before the alloy starts to melt (lower melting point), so as to cover it entirely and in good time.

These two considerations decide the limits of the admissible melting point of a flux: in general it can be said that the melting point of a flux should be at least about 50-100° C. below the lower melting point of the alloy. The practical man will, therefore, always keep in stock dry mixtures of fluxes with varying melting points and properties suited to special conditions, and in dealing with alloy scrap of unknown composition he will first select a flux, which he can easily exchange for the next higher or lower melting flux mixture.

Acceleration of Melting

How far the application of a flux can reduce the loss of heat by radiation from the surface of liquid metal, *e.g.*, in a crucible, is not known, but it is a fact that the application of fluxes makes an acceleration of the melting process possible, apart from a much better yield and a having of time in skimming the dross. On the other hand, it must be borne in mind that the application of fluxes usually shortens the life of the crucible, and that even special bricks in a furnace will suffer from the attack of some fluxes.

C. Chemical Conditions.—The difference between the fluxes and the slags consists in the ability of the latter to dissolve the resultant metallic oxides completely, while the capacity of the fluxes to dissolve aluminium oxide, according to recently published experiments, is surprisingly small, and generally not above 2-5 per cent. of the quantity of flux used. This is based on the fact that one can neither reduce the aluminium oxide at the prevailing melting temperatures nor make it capable of forming new compounds easily; it depends also on the origin and the conditions of formation of the aluminium oxide, because Al_2O_3, which originates with the melting of aluminium (melting point 658° C.) or its lower melting alloys (500-620° C.), alters its crystalline structure when heated to 850° C., so that its solubility and susceptibility to the action of fluxes is almost completely lost. It is, therefore, a rather hopeless undertaking to add fluxes to an overheated melt in order to reduce the inevitably high metal losses.

Experiments by Klyaschko on the silicon content of aluminium alloys (Si is practically always present in varying degrees and is a highly surface-active metal) have shown that composite oxide films are formed, which in their chemical composition are similar to sillimanite ($Al_2SiO_5 = Al_2O_3.SiO_2$) and to kaolin ($Al_2Si_2O_7 = Al_2O_3.2SiO_2$). These silicates have a rather high specific gravity (3.02 for sillimanite) and a melting point of 1600-1800° C. and they can not be disaggregated in any flux at a temperature between 700° and 800° C. It is therefore clear that fluxes, as adopted from copper smelting in the earlier literature and recommended for the remelting of aluminium turnings (*e.g.*, 66 per cent. Na_2CO_3 and 34 per cent. charcoal), can at the best only partly answer their purpose, as the CO atmosphere gives no protection against the oxidation of aluminium and the carbonate of soda can only cause the formation of sodium aluminate, $Na_2Al_2O_4$, which has a specific gravity of 29 and a melting point of 1500° C.

Neither can borax—although it can be applied so successfully in the melting of copper and bronzes—be used satisfactorily. While borax, according to the equation $Na_2B_4O_7 + CuO = (Cu(BO_2)_2.2NaBO_2)$, can dissolve in 100 parts 36 parts of copper oxide, the equation $3Na_2B_4O_7 + Al_2O_3 = 2(Al(BO_2)_3.3NaBO_2)$ shows that 100 parts of borax can theoretically dissolve only 16 parts of Al_2O_3, and publications on experiments mention that molten borax at a temperature of 800° C. can dissolve scarcely more than 2 per cent. Al_2O_3. Crystallised borax, $Na_2B_4O_7.10H_2O$, which, through loss of most of its water of crystallisation, is converted at a temperature of 125° C. into $Na_2B_4O_7.H_2O$, loses the rest of the water by further heating, and the anhydrous salt has a melting point of 750° C. The latter is, however, too high to serve as a flux for aluminium alloys and the presence of larger quantities of borax in fluxes raises both their melting point and their viscosity considerably.

The Halogen-Containing Fluxes

As no real success could be expected from the attack of such fluxes on aluminium oxide, aluminium silicate, or aluminates, flux-users had to seek out another way, namely, to attack the metal itself and to detach the oxide film mechanically rather than chemically, in such a way that the surplus of flux partly dissolves, but mostly only suspends and thus collects the oxide film, so bringing the oxide out of contact with the aluminium. This effect can be gained very satisfactorily principally by chlorides, bromides, silicofluorides, and boron and titanium double fluorides; also to a certain degree by means of sulphates, bisulphates, and metaphosphates. While chlorine and bromine alone do not attack the aluminium, the strongly dissociated halogen salts are very active in the molten state; they can penetrate the oxide film and react with the aluminium, with formation of a certain amount of aluminium halides, all of which are volatile and serve, like the SiF_4 liberated from the silicofluorides, to remove the oxide film from the metal by a completely mechanical process in which the metal bath is strongly agitated.

In melting of pure, dry and grease-free sheet cuttings of aluminium it is sufficient to use ammonium chloride or ammonium bifluoride to obtain a pure slag-free metal. For aluminium alloys with a low melting point, containing 12 to 14 per cent. zinc, such as 3L5 (melting interval 580°-610° C.) zinc chloride (melting point 320° C.) is used. Then,

in accordance with the equation $2Al + 3ZnCl_2 = 3Zn + 2AlCl_3$, aluminium chloride volatilises and zinc is set free, increasing the zinc content of the alloy, though not by more than 0.1-0.2 per cent.

Increased contamination with zinc can be expected from aluminium alloys with magnesium contents, because magnesium reacts with zinc chloride at melting temperature, according to the equation

$$3Mg + 2ZnCl_2 = 2MgCl_2 + MgZn_2$$

and the metallic compound $MgZn_2$ dissolves in the aluminium alloy. Similarly, fluxes containing copper chloride can be used for the alloys 3L8 and 4L11 and fluxes containing manganese chloride for manganese-containing alloys like Hiduminium 23, BA 40/M, DTD 165 and also for L23. By their agency Cu and also Mn enter the aluminium alloy.

When the flux has only to serve as a protective cover, sodium or potassium chloride or fluoride, as well as calcium chloride or calcium fluoride can be used. Even with the alkaline chlorides the reaction with aluminium takes place, though on a small scale, resulting in the formation of colloidal sodium or potassium; the so called salt-modification of silicon-aluminium alloys, using, *e.g.*, 66 per cent. NaF + 34 per cent. NaCl, instead of or prior to treating with sodium, is doubtless based on this reaction. This does not, however, quite explain the fact that pure chloride mixtures alone or pure fluoride mixtures alone are less active than fluxes which contain both chlorides and fluorides. Approved commercial mixtures contain mostly between 5 and 20 per cent. of fluorides, silicofluorides, or the sodium aluminium fluorides: cryolite, Na_3AlF_6 = $3NaF.AlF_3$, or chiolite, $5NaF.3AlF_3$. Presumably the fluorides attack the oxide as well as the metal and penetrate the oxide film quicker, while the aluminium so exposed reacts with the chlorides resulting in the formation of $AlCl_3.NaCl$ or $AlCl_3.KCl$ as well as gaseous $AlCl_3$.

Whereas the melting point of cryolite (920° C.) and its specific gravity of 2.95 are too high to use this salt alone as a flux—and this applies also to sodium fluoride (m.p. 988° C., sp. gr. 2.75)—there exist in the system $NaF-AlF_3$ two eutectics, having lower melting points, which are: 63 per cent. AlF_3 + 37 per cent. NaF (m.p. 685° C.); and 24 per cent. AlF_3 + 76 per cent. NaF (m.p. 880° C). The latter, equivalent to a composition of 60 per cent. Na_3AlF_6 + 40 per cent. NaF, was found to dissolve up to 20 per cent. Al_2O_3 at a temperature of 910° C.

In the ternary system $NaF - AlF_3 - CaF_2$ we find two eutectic mixtures: 60 per cent. AlF_3 + 34 per cent. NaF + 6 per cent. CaF_2 (m.p. 675° C.); and 36 per cent. AlF_3 + 54 per cent. NaF + 10 per cent. CaF_2 (mp. 905° C.). The latter, corresponding to a composition of 90 per cent. Na_3AlF_6 + 10 per cent. CaF_2 has a dissolving power for Al_2O_3 of up to 10 per cent., at a temperature of 910° C.

Sodium silicofluoride, Na_2SiF_6, reacts with aluminium itself with liberation of silicon according to the equation: $3Na_2SiF_6 + Al = 3Si + 6NaF + AlF_3$ (and the silicon dissolves in the alloy), while mixtures of fluorspar and potassium bisulphate, which are also in use, react on the aluminium oxide as well as on the metal: $3CaF_2 + 6KHSO_4 + Al_2O_3 = K_2SO_4 + CaSO_4 + 2AlF_3 + 3H_2O$, and $3CaF_3 + 6KHSO_4 + 2AL = K_2SO_4 + CaSO_4 + 2AlF_3 + 3H_2$.

The generation of water or of hydrogen makes these fluxes unreliable for melting processes, whilst small additions of $KHSO_4$ or K_2SO_4 or Na_2SO_4 give good results as components of welding fluxes.

(To be continued)

Zinc-Base Die-Casting Alloys

Low-Aluminium Substitute Tested

UNDER the A.S.T.M. Committee B-6 on Die-Cast Metals and Alloys investigations have been conducted on the possible reduction in aluminium content from about 4 to 1.5 or 2.0 per cent. in the widely used alloys No. XXIII and XXV in the A.S.T.M. Specifications for Zinc-Base Alloy Die Castings (B86-38T). Before recommending definite steps in conservation of this strategic material, tests were made to answer questions on possible manufacturing difficulties relating to hot-shortness, shrinkage, freezing range, and casting characteristics of the lower aluminium alloys. A statement of developments in this work has been prepared by the sub-committee on zinc-base die-casting alloys.

Alloy XXIII is a zinc-base alloy containing 4 per cent. of aluminium and about 0.03 per cent. of magnesium. Alloy XXV differs by the inclusion of 1 per cent. of copper. Both alloys are compounded with special high-grade zinc (99.99 per cent.), A.S.T.M. Specifications B6-37.

The eutectic in the zinc-aluminium system occurs at about 5 per cent. of aluminium. Alloys containing 4 per cent. of aluminium are close to the eutectic composition and have a short freezing range. They possess a minimum of casting difficulties, and adoption of this aluminium content in developments of these alloys was based largely on good casting properties coupled with what appeared to be the optimum combination of physical properties.

These standard alloys have been in commercial use for over 10 years with satisfactory service records. Because of the aluminium shortage in America, reports *News Edition*, the possibility of using alloys with less than 4 per cent. of aluminium is being investigated. Preliminary results based on laboratory tests are available, and some conflicting commercial experience has been reported in use of such low-aluminium alloys. This information, whose incomplete character cannot be too strongly emphasised, has been reviewed and is presented briefly. There is no assurance that properties on which tests are not yet available may not interfere with certain use of these alloys. With respect to laboratory tests, Apex Smelting Co. has reported data from which is taken the following comparison of A.S.T.M. alloy XXV, containing 4.1 per cent. of aluminium, 1.0 of copper, and 0.03 of magnesium, with a low-aluminium substitute, containing 1.5 per cent. of aluminium and the same percentages of copper and magnesium:

	Alloy XXV	Substitute Alloy
Tensile strength, as cast, p.s.i. ...	44,300	40,400
Tensile strength, 10-day, 95° C. water vapour, p.s.i.	34,500	28,000
Elongation, as cast, per cent. ...	5.3	5.7
Elongation, 10-day, 95° C. water vapour, per cent.	3.7	5.7
Charpy impact (average gate and vent) as cast, ft.-lb.	38.5	34.0
Charpy impact (average gate and vent) 10-day, 95° C. water vapour, ft.-lb.	6.7	12.8
Dimensional change on 6 in. bar, 10-day 95° C. water vapour, in.	−0.0002	−0.0006

NEW BOOK ON WELDING TRAINING

A new book to assist instructors in planning courses for the training of oxy-acetylene welding and cutting operators has just been published by the International Acetylene Association, New York. The book, "Training Oxy-Acetylene Welding and Cutting Operators—Instructors Outlines" is divided into three practically arranged chapters. The first outlines the information essential to the training of a general welding operator, an aircraft-welding operator, and a pipe-welding operator. The second chapter covers the same field for cutting operators, and the third details a course for inspectors and the primary requirements of students who take the inspector's course. Suggestions for completing other types of specialised courses are likewise included. Copies of this 88-page book can be obtained from the Secretary, International Acetylene Association, 30 East 42nd Street, New York, N.Y. Paper-bound copies are 25 cents (1s. 3d. each).

Producer Gas for Metallurgy

Ash Disposal Provision in Plant Design

THAT the development and substitution of producer gas for oil as a fuel in metallurgical operations has become a matter of world-wide interest, is evidenced by an article published recently in *The Commonwealth Engineer* of Australia. Special reference is made in the article to an installation of three large producer-gas units recently erected at the works of the Electrolytic Zinc Co. of Australasia, Ltd., at Risdon, Tasmania. An important problem in connection with the design of these producers, and one that may well arise esewhere, was the use of the locally-mined coal, which has an ash content of up to 25 per cent. Since each producer has a normal rating of 15 tons of coal gasified per day, it required the disposal of about 3 tons of ash over the 24-hour period. This condition has been met satisfactorily in the design.

Each producer is of 8 ft. 6 in. inside diameter and has a water jacket which provides steam for the air and steam blast. It is of the updraught revolving bottom type with automatic ash discharge and zoned blast distribution. The rotary grate is divided into eight sections through which the mixture of air and steam is blown. Each section is automatically and individually controlled, thereby giving a zoned distribution. The saturation of the blast is controlled by a thermostat in the blast pipe and the pressure in the gas mains is also automatically controlled. The gas from these producers is used in three rotary dryers for residues, three reverberatory furnaces for zinc, a battery of Leggo roasting furnaces, and an Edwards type roaster.

Detecting Phosphorus in Steel

Using the Radioactive Isotope

THE concentration of phosphorus on the surface of the small air pockets or blow-holes in iron or steel has recently been proved by using radioactive "tracers," according to experiments carried out by W. M. Shoupp, research physicist of the Westinghouse Company. A sample batch of steel was melted into which were put radio-active atoms, or tracers, of the phosphorus isotope. The phosphorus had been made artificially radioactive by bom-bardment in an atom-smasher. The rays emitted do not affect the action of the phosphorus, but they reveal the location of the atoms from which they are sent out. A simple "camera," consisting of a tin can, two small brass discs, and a screw clamp, was improvised for this experi-ment.

A small disc of steel was moulded containing the tracer atoms. In a dark room, a piece of photographic film was laid on each side of the disc, two small brass plates were placed outside the film, the stack of film clamped, and the whole placed in a tin can to keep out all light. The de-veloped film revealed blotches caused by the rays from the activated phosphorus atoms. The light areas on the print corresponded with the blow-holes in the steel disc, indicating that the phosphorus had concentrated on the surfaces of these holes.

This simple method can be used to reveal the location of other substances besides phosphorus. For example, steel also contains small amounts of sulphur, carbon, man-ganese, and silicon. Any of these substances can be made into tracers with an atom-smasher.

PAINT PROTECTION FOR MAGNESIUM PRODUCTS

A standard practice developed in Germany for the pro-tection of products of magnesium and magnesium alloys consists of three parts: preparation of the surface, ground-ing, and finishing. A suitable surface is normally obtained by immersion in a strong solution of nitric acid and sodium bichromate, preferably followed by immersion for as long as 30 minutes in a boiling solution of sodium bichromate. An alternative preparatory treatment consists in immer-sion for 5 minutes in a 15-20 per cent. hydrofluoric acid solution and for 45 minutes in a 10 per cent. sodium or potassium bichromate solution. The best grounding material is zinc chromate, which was found superior to mixtures of iron oxide and zinc chromate. Addition of synthetic resins is recommended to improve the water resistance; alkyd phenolic resins have given good service on surfaces which come into contact with sea water. The best finishing paints are aluminium paints. A suitable binder for the top coats is phenol resin lacquer with one part of linseed oil and three parts of tung oil.

Forthcoming Events

The Science Faculty of the Marx Memorial Library and Workers' School is organising a symposium on "Science and Technology in the Soviet Union" and "The Scientific Attitude to Fascism with Particular References to Racial Theories," which will be held on **April 5** and **6**, at the London School of Hygiene and Tropical Medicine, when papers will be read by Professors J. B. S. Haldane, F.R.S., H. Levy, J. D. Bernal, F.R.S., Dr. P. Gore, Dr. C. Hawkes, Dr. G. M. Morant, and Dr. J. Needham, F.R.S.

A meeting of the Birmingham Section of the **Electrodepositors' Technical Society** will be held at 6 p.m., on **April 7**, at the James Watt Memorial Institute, Great Charles Street, when W. F. Jesson will present a paper on "Solvent Economy on Trichlor-ethylene in Degreasing Paints."

The annual meeting of the **Food Group, Society of Chemical Indus'ry,** will take place at 2.15 p.m., on **April 8,** at the Chemical Society's rooms, Burlington House, London, W.1. The meeting will be followed by an address from Dr. J. Hammond, F.R.S., on "Animal Production in the Post-War World."

There will be a meeting of the **Electrodepositors' Technical Society** at the Northampton Institute, St. John Street, E.C.1, at 5.30 p.m., on **April 13,** when a paper on "Experiences in Alkaline Zinc Plating" will be read by J. S. Jones and P. M. Walker.

The annual general meeting of the Yorkshire Section of the **Society of Chemical Industry** will be held, at a joint meeting with the Food Group, at the Hotel Metropole, Leeds, at 3 p.m., on **April 13,** when, under the general heading of "Colour in Foods," papers will be presented by D. J. T. Bagnall, F.I.C.; Professor J. W. Cook, F.R.S.; D. A. Harper, Ph.D.; and N. Strafford, F.I.C.

"Laboratory Design" is the title of the discussion which will be opened by Mr. J. McKillop, Mr. W. E. Prytherch, and Mr. P. L. Bilham, at the meeting of the **Society of Chemical Industry,** to be held in the rooms of the Chemical Society, Burlington House, W.1, at 2.15 p.m., on **April 13.**

A joint meeting of the **Chemical Engineering Group** (Society of Chemical Industry) and the **Institution of Chemical Engineers** will be held on **April 14,** at 2.30 p.m., in the rooms of the Geological Society, Burlington House, W.1, when a dis-cussion on "The Development of New Chemical Processes" will be opened by H. M. Cremer, M.Sc., F.I.C., M.I.Chem.E., chairman of the Chemical Engineering Group.

At a meeting of the London and S.E. Counties Section of the **Institute of Chemistry,** to be held at the Institute on **April 15,** at 6 p.m., Dr. Hugh Nicol will speak on "The Use of Chemicals by the Green Plant."

The Royal Society of Arts is holding a meeting at John Adam Street, Adelphi, W.C.2, on **April 15,** when J. C. Dawes, O.B.E., M.I.Mech.E., Deputy Controller of Salvage, will be speaking on "Making Use of Waste Products."

The Chemical Society announces that the Sir Joseph J. Thomson Memorial Lecture will be given by the Right Hon. Lord Rayleigh, F.R.S., in the Lecture Theatre of the Royal Institution, at 4.30 p.m., on **April 16.**

The annual meeting of the Liverpool Section of the **British Association of Chemists** will be held at the Bradford Hotel, Tithebarn Street, at 6 p.m., on **April 21.**

General News—From Week to Week

Special consideration is to be given to claims by pithead bath committees for small supplementary allowances of soap for use in the baths. Increased allowances will not exceed 4 oz. per head per week, except in the case of collieries where the coal dust has particularly adhesive qualities which affect soap consumption, when up to 6 oz. per head may be allowed.

The Secretary for Mines announces that the explosives "Plastex No. 2" and "Plastex No. 2 (Sheathed)" manufactured by Messrs. Explosives and Chemical Products, Ltd., have been added to the List of Permitted Explosives for general use in mines to which Part II of the Explosives in Coal Mines Order applies. The sheath is of sodium bicarbonate, either felt or powder.

Foreign News

Sunday work has been introduced into Swiss synthetic fibre works to cope with the increasing demand.

French dyestuffs prices have been raised by 25 per cent. to offset increases in producing costs. They are now 41 per cent. above the level of September, 1939.

The duty on the import of copper sulphate into Portugal is announced as having been suspended for six months from February 25, the date of the official decree enacting the suspension.

The U.S. Department of Commerce has submitted a confidential study of the British system of controlling prices to the White House and all agencies concerned with the problem of keeping down prices, reports Reuter from Washington.

A new oxygen factory will begin operations in Sweden by August next. The factory, which is being built by Nordiska Syrgasverken A/B, at Kneippbaden, near Norrköping, will help in meeting local demands which the existing plant at Motala is no longer able to cover.

Turpentine oil and by-products will be obtained from tree stumps in a new factory being built at Los (Sweden). The Swedish Government has formed A/B Statens Skogsindustrier to control the state interests in sawmills, cellulose factories and wood distillation plants.

Wood hydrolysis in Germany has been much expanded, according to the report of Deutsche Berginwerke A.G. für Holzhydrolyse, and the plant for the manufacture of yeast has proved successful. In at least one branch factory, however, raw materials other than originally intended have had to be used.

The Hungaria Fertiliser, Sulphuric Acid, and Chemical Industry Company has amalgamated with two other leading Hungarian chemical firms: the Metallurgical Chemistry, Smelting Works, Chemical Industry and Commerce Company, and the Phoenix Sulphuric Acid and Chemical Products Works Company, of Nagybanya.

The I.G. Farbenindustrie A.G. has "purchased" the Polish Boruta Chemical Industry Company, at Lodz. The company will be known as the Teerfarbenwerke G.m.b.H. In addition to dyestuffs and by-products, other chemical products, mainly for the textile industry, will be produced in the factory, which will be enlarged and modernised.

The total mine production of recoverable lead and zinc in the United States and Alaska in 1941 (including that made into pigments and chemicals direct from ore) was 459,756 short tons of lead and 735,865 short tons of zinc, according to preliminary figures of the Bureau of Mines. These figures show increases over 1940 of less than 1 per cent. in lead output, and of 11 per cent. in that of zinc.

Among the chemical industries developed in unoccupied China since the outbreak of Sino-Japanese hostilities, alcohol plants have shown very rapid growth. During the past four years 36 alcohol plants have been erected with private capital. Total capacity of these factories is 4,500,000 gallons annually. The large production of sugar cane in Szechwan yields large amounts of molasses to be used as raw materials for the alcohol plants.

Wolfram in Portugal must be sold only by mine owners to the Government Department for ore, according to a Reuter report from Lisbon.

Hardly any sulphite pulp was produced for paper manufacture in Sweden in 1941, the production at the mills having been mainly concentrated on fodder cellulose, with spirit as a by-product. By-products from sulphate production, such as rosin and turpentine, have fetched good prices and have helped to cover the country's requirements of soap.

Caustic soda and bleaching powder are produced by electrolysis of salt found in Szechwan. Construction of a large-size soda-ash plant is being held up because of difficulty of importing machinery. Production of caustic soda by privately owned factories in unoccupied China amounted to 518 tons during the first half of 1940, and 454 tons during the first half of 1941. Production during the second half of 1940 amounted to 765 tons. Only seven tons of bleaching powder were produced in the first half of 1940, but 192 tons were made during the first half of 1941. Production of bleaching powder for the entire year 1940 amounted to 137 tons.

British Chemical Prices

Market Reports

VALUES continue on a firm basis in almost every section of the general chemicals market, and the movement to the chief consuming industries has been on a satisfactory scale. There has been no alteration in the general supply position and new bookings are mostly in the nature of contract renewals. There is a good demand for chlorate of soda with supplies none too plentiful, and in this respect both yellow prussiate of soda and bichromate of soda are similarly placed. A scarcity of offers continues to be the chief feature in the potash section, and amongst the miscellaneous chemicals formaldehyde and barium chloride are receiving a brisk inquiry. Offers of acetic acid and oxalic acid are readily absorbed, whilst inquiries for tartaric and citric acids are very difficult to place. There have been no important changes in the coal tar products market and trade on the whole has been of moderate dimensions. Contract deliveries for carbolic acid and cresylic acid continue along steady lines and an active interest is displayed in both solvent naphtha and heavy naphtha.

MANCHESTER.—The leading industrial users of heavy chemical products in this area seem to be pretty well covered so far as contract requirements are concerned, and no more than a moderate weight of new business has been arranged on the Manchester market during the past week. On the whole, good quantities of such materials as caustic soda, soda ash, bicarbonate of soda, saltcake, and the ammonia and magnesium compounds are moving into consumption locally, and the general price position is firm. Among the tar products, there is a steady call for supplies of crude tar, creosote oil, and carbolic acid, and also for most of the light classes.

Price Changes

Arsenic.—For 1-ton lots, £41 to £46 per ton, according to quality, ex store; for 20-ton lots, £35 to £40 per ton d/d. Intermediate prices for intervening quantities.

Latest Oil Prices

LONDON.—March 30.—For the period ending May 2, per ton net, naked, ex mill, works or refinery, and subject to additional charges according to package and location of supplies: LINSEED OIL, raw, £41 10s. RAPESEED OIL, crude, £46 5s. COTTONSEED OIL, crude, £31 2s. 6d.; washed, £34 5s.; refined edible, £43 10s.; refined deodorised, £44 10s. COCONUT OIL, crude, £28 2s. 6d.; refined deodorised, £35 10s. PALM KERNEL OIL, crude, £27 10s.; refined deodorised, £35 10s.; refined hardened deodorised, £39 10s. PALM OIL, refined deodorised, £41 10s.; refined hardened deodorised, £44 10s. GROUNDNUT OIL, crude, £35 10s.; refined deodorised, £44 10s.; refined hardened deodorised, £48 10s. to £49 10s. WHALE OIL, crude hardened, 42 deg., £30 10s.; refined hardened, 42 deg., £37 10s. ACID OILS.—Groundnut, £19; soya, £17; coconut and palm kernel, £22 10s. ROSIN, 26s. 6d. to 33s. per cwt., ex wharf, according to grade. TURPENTINE, American, 90s. per cwt., in drums or barrels, as imported (controlled price).

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Companies Winding-Up Voluntarily

OCEAN OIL COMPANY, LTD. (C.W.U.V., 4/4/42). By special resolution, March 12. Charles Edward Swinson, 9 Camomile Street, London, E.C.3, appointed liquidator.

Satisfaction

BRITISH OIL & CAKE MILLS, LTD., London, E.C. (M.S., 4/4/42). Satisfaction, March 6, of deb. stock reg. November 25, 1912, January 4 and July 26, 1917, July 26, 1918 and July 31, 1935, to the extent of £2,290.

Declaration of Solvency Filed

GYPSUM COMPANY OF IRELAND, LTD., London, W. (D.S.F., 4/4/42). March 11.

Company News

The Eastern Chemical Co., Ltd., report gross profit for year ended March 31, 1941, of £34,748 (£20,805).

Thompson Brothers (Bilston), Ltd., have declared an interim dividend of 7½ per cent. (same).

The Imperial Smelting Corporation, Ltd., have declared a dividend of 3¼ per cent. on the 6½ per cent. cumulative preference shares, in respect of the year to June 30, 1942.

The Eaglescliffe Chemical Co., Ltd., report a dividend of 3 per cent. on 6 per cent. cumulative preference shares in respect of the six months to March 31, 1942.

The British Aluminium Co., Ltd., announce net profit for 1941 of £517,332 (£508,156), and a final dividend of 7 per cent., making 10 per cent. for the year (same).

Monsanto Chemicals, Ltd., report a net profit for 1941 of £67,958 (£105,854), and have declared a dividend of 16 2/3 per cent. (23 1/3 per cent.), for the year.

Doulton and Co., Ltd., announce a net profit for 1941 of £35,768 (£31,424), and have declared a dividend of 5 per cent. (same) for the year.

Cooper, McDougall and Robertson, Ltd., have declared an interim dividend of 5 per cent., less tax, on ordinary shares, for the year ended September 30 last.

The British Oxygen Co., Ltd., is paying a final dividend of 7 per cent., less tax, on ordinary shares, making 14 per cent. for the year (15 per cent.).

United Glass Bottle Manufacturers, Ltd., have declared a final dividend of 6 per cent. and a cash bonus of 2½ per cent., making 12 per cent. for 1941 (same). Net profit was £196,317 (£236,345).

The Viscose Development Co., Ltd., report gross profit for 1941 of £56,541 (£46,282), and have declared a final dividend of 4 per cent., making 7 per cent., for the year (10 per cent.) on both preference and ordinary shares.

Hadfields, Ltd., announce net profit for the year ended December 31, 1941, of £198,904 (£259,621), and have declared a final dividend of 15 per cent., making 22½ per cent., the rate which has been paid for a number of years.

The British Xylonite group of companies report that gross profits for 1941 amounted to £826,753, an increase of £242,319 on the previous year. A final dividend of 7½ per cent. has been declared, making 10 per cent. for the year (same).

New Companies Registered

Metal Salts, Ltd. (372,787).—Private company. Capital: £15,000 in 15,000 shares of £1 each. Manufacturers and refiners of and dealers in metals, alloys, salts, minerals and chemicals, etc. Directors: G. H. Owtram; D. R. Paton. Registered office: Victoria Works, Wincham, near Northwich.

Liquid Rosin Importers Association, Ltd. (372,758).—Company limited by guarantee without share capital. To co-operate with and assist the Ministry of Supply in the allocation and distribution in the United Kingdom of liquid rosin and such other products as may be agreed, to promote and protect the interests of importers of such products, etc. Membership is restricted to the subscribers, and such persons as were engaged in the trade prior to the war. First members of the Management Committee: H. H. Berlandina, O.B.E., M.C., C. C. Greig; W. Mann; G. Millard; T. Stromwall. Registered office: 84 Leadenhall Street, E.C.3.

Abel Woodhead & Sons (Chemicals), Ltd. (372,615).—Private company. Capital £2500 in 2500 shares of £1 each. To acquire the business of chemical manufacturers, drysalters, soap makers and fertiliser manufacturers carried on at Liphill Bank Chemical Works, Holmfirth, Yorks., as "A. Woodhead & Son." Permanent directors: H. Woodhead; T. Woodhead.

"Recla" Reclaiming Company, Ltd. (372,653).—Private company. Capital: £300 to 300 shares of £1 each. Manufacturers of and dealers in chemicals, metals, metallic substances, paper, rubber, rubber goods, scrap metals, scrap rubber, essential and other oils, fats, waxes, dyes, gums and by-products, etc. Directors: A. Lane; Mrs. Emma C. Lane, both of 6 Canning Crescent, N.22.

Chemical and Allied Stocks and Shares

ALTHOUGH inactive conditions continued to rule in the stock and share markets, sentiment has been assisted by the success achieved by London's Warships Week, and security values have remained steady in the absence of selling. Most shares of chemical and kindred companies reflected the general tendency, and the disposition in various instances has been to await forthcoming financial results and dividend announcements. Imperial Chemical at 32s. 6d. were, in fact, maintained on balance on hopes that the dividend may be unchanged at 8 per cent., while the 7 per cent. preference units made the slightly higher price of 35s. 10½d. B. Laporte were inactive and remained at 63s. 9d.; in this case the financial results can be expected in May—in respect of each of the three previous years' earnings on the shares were well in excess of the dividends paid. Pending the results, General Refractories 10s. shares were again 8s. 10½d. and Amalgamated Metal ordinary kept at 12s. 9d. British Match were 34s. 3d. the disposition being to await the results and those of the Bryant and May subsidiary. British Drug Houses shares were again firm at 26s. 3d. Elsewhere, minor fluctuations were shown in British Plaster Board ordinary, which are 21s. 3d. at the time of writing.

Whereas Associated Cement remained dull at 45s. on fears of a lower dividend, there was a firmer tendency in various iron and steel issues, including Stewarts and Lloyds. Preliminary results of the last-named company are impending, as are those of Babcock and Wilcox, whose ordinary shares were slightly better at 44s. There was a fair number of dealings in Richard Thomas issues. In other directions, Tube Investments remained at 82s. 6d., no change being generally expected in the forthcoming interim payment. Barry and Staines receded further to 30s. and Nairn and Greenwich kept at the lower level of 55s. to which they went recently. Borax Consolidated deferred, which remained under the influence of the chairman's annual review, were again better, having further improved to 31s. at the time of writing. On the other hand, there has been a reaction from 67s. 9d. to 66s. 10½d. xd. in British Oxygen, which were influenced by the 1 per cent. reduction in the dividend. Steadiness was maintained in British Aluminium at 43s.

A number of shares of companies with interests in plastics again showed a fair amount of dealings, including British Industrial Plastics 2s. ordinary, which were quoted at 3s. 6d. Lever and Unilever had a better appearance, and the various classes of preference shares were reported to be firm, while British Oil and Cake Mills preferred ordinary showed a small improvement to 40s. 9d. Aided by satisfaction with the maintenance of the year's distribution, United Glass Bottle kept at 55s. Elsewhere, Forster's Glass 10s. ordinary were dealt in at 19s. at one time. Greeff-Chemicals Holdings 5s. units have transferred at 5s. 6d. Monsanto Chemicals 5½ per cent. preference shares at 22s. 6d. were the same as a week ago. Trading profits of the last-named company rose by £50,190 to £500,710 last year, but the provision for taxation was £84,010 higher at £370,559. In some directions, sentiment was aided by continued market talk that the Budget may bring some modification of E.P.T., although there are divergent views in the City as to this possibility. It is, however, generally felt that, whereas the trend in security values will be dominated by the war news, there is unlikely to be any appreciable improvement in the volume of business, bearing in mind the widespread tendency to await the Budget.

A better trend developed in the units of the Distillers Co. which were 73s. 9d. compared with 72s. 9d. a week ago. United Molasses were 29s. but appear to have a firmer undertone at the time of writing; the financial results are due in May, as are the preliminary figures of Dunlop Rubber. The units of the latter company, which are around 25s. 6d. at the time of writing, have declined in recent weeks on market fears of a lower distribution owing to the company's interests in the Far East. No very decided trend has been observable in oil shares at the time of writing.

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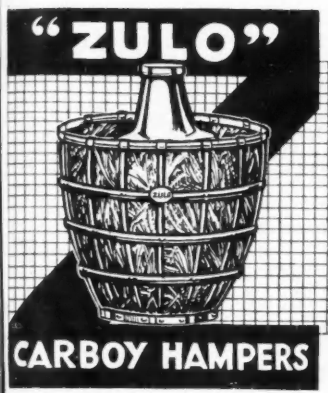
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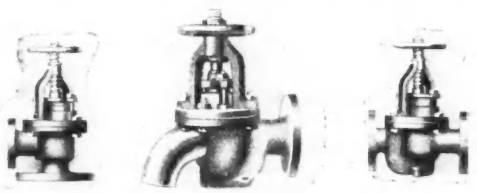
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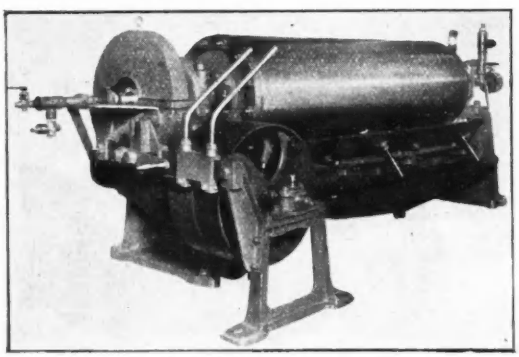
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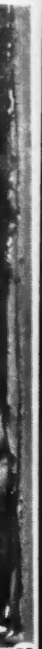

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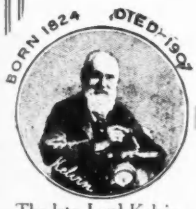

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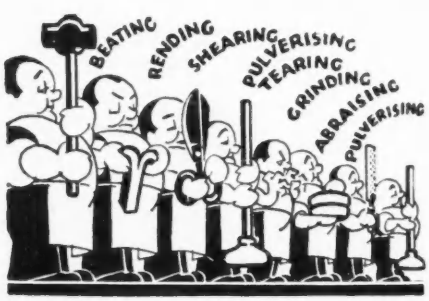

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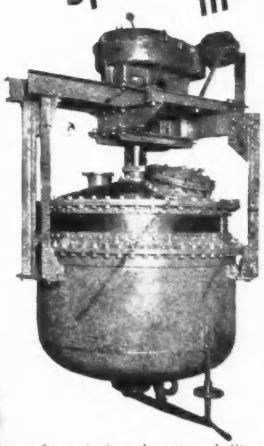

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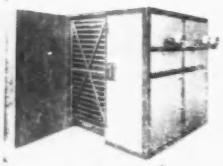

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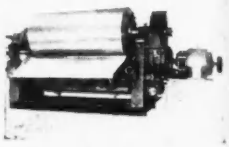

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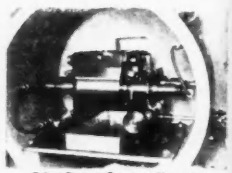

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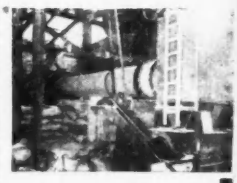

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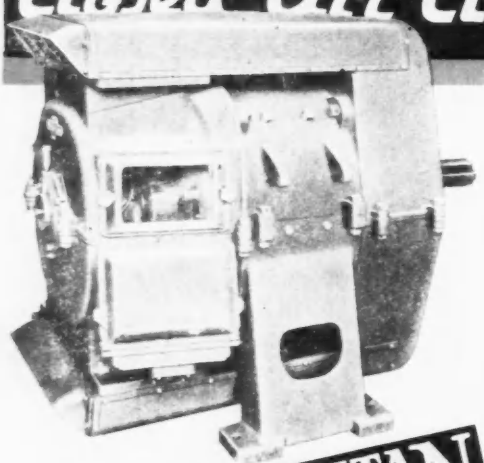
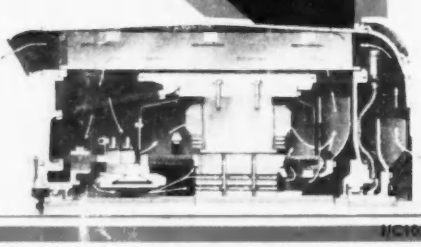
C

A totally-enclosed Closed Air Circuit Motor



The "Metrovick" totally enclosed motor with integral fan operated air cooling circuits is designed for use in the corrosive and dusty atmospheres of Chemical and Gas Works.



METROPOLITAN Vickers ELECTRICAL CO. LTD. TRAFFORD PARK MANCHESTER 17.

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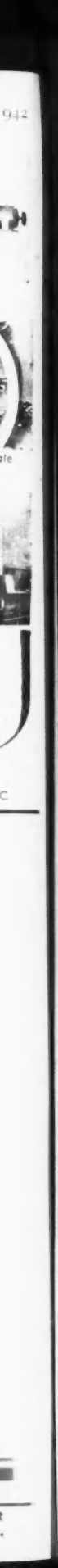
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